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Account of the Research in Progress in the British Empire	3	6

Plant Breeding Abstracts.
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Part I. British Empire

STATISTICS 519

523. MAHALANOBIS, P. C. 519.242
A statistical note on the method of comparing mean values based on small samples.
Ind. J. Agric. Sci., 1932 : **2** : 28–41.

The object of the author is to give for the benefit of workers in India a description of the methods made familiar to statistical workers in this country and elsewhere through the writings of "Student" and R. A. Fisher, although the former of these, the real author of the method, is not mentioned. All the details necessary for working out the calculations are given, and a table is provided by means of which it is possible on the one hand to determine the significance of an observed result, and on the other to ascertain the size of sample required with a known standard deviation to ensure that a difference of a certain magnitude is significant. The particular example chosen, having five series, is more appropriately treated by the methods of the analysis of variance, and it is to be hoped that the author will find an occasion to do with that what he has done here for a special case. There is a discrepancy between the author's definition of t and that of R. A. Fisher. The denominator in formula (3), p. 33, should be calculated in the first instance by adding together the two sums of squares and dividing by the total number of degrees of freedom, instead of calculating separate estimates of variance for the two series.

524. MUNDKUR, B. B. 575.1:519.251.9
Calculation of probable error of Mendelian ratios.
Ind. J. Agric. Sci., 1932 : **2** : 42–46.

The author gives for the benefit of genetical workers the well-known formula for the probable error of the binomial, to be used for ascertaining the significance of a ratio when there are two classes only. His suggestion for pooling when there are more than two classes is, however, unsatisfactory, and although he mentions the use of the Chi-squared test by some writers, he does not describe it, so that his paper does not go so far as some of those to which he refers.

ECONOMIC PLANTS 633

525. 633:575
Development in plant genetics.
Farming in South Africa 1932 : **6** : 485–86.

A brief explanation in popular terms of the principles of genetics, with an indication of some of the practical results which are to be obtained by modern methods.

526. BANERJI, J. 633:576.312.35
Chromosome numbers of Indian crop plants.
J. Ind. Bot. Soc. 1932 : **11** : 82–85.

The haploid number 7 was determined for *Corchorus capsularis*, *C. olitorius* and *C. acutangulus*.

527. HARRINGTON, J. B. 633.1:581.162.32
Natural crossing in wheat, oats and barley at Saskatoon, Saskatchewan.
Sci. Agric. 1932 : **12** : 470–83.

Five-year experiments with wheat and oats, and three-year experiments with barley, with common Saskatchewan varieties differing in such easily distinguishable characters as glume colour and grain colour, were carried out to determine the amount of natural crossing.

Wheat showed 0.88 per cent natural crossing, ranging from 0·00 per cent to 2·16 per cent. Hulled oats averaged 0.07 per cent but the single hull-less variety used out-crossed more freely and in one year reached as much as 9.82 per cent. Hulled barley varieties averaged 0.07 per cent and the single hull-less variety, 0·16 per cent.
The weather appeared to influence the amount of out-crossing in wheat and barley to a certain extent, more out-pollinating occurring during the more humid years. But as the latter were accompanied by more wind than the dry years, it is uncertain whether degree of humidity or velocity of wind was the effective factor. The seasonal differences in amount of natural crossing, however, were completely outweighed by those between varieties. An inspection of the wheat data appeared to indicate that natural crossing was mainly confined to adjacent varieties within a radius of seven feet.

528. NAZARETH, B. 633.11 Bansi : 575 (54.7)
Bansi wheat of the Bombay Deccan and its improvement.
Bull. Dept. Agric. Bombay 1931 : **166** : 28 pp.
Bansi wheat, the chief variety of the Deccan districts, is a form of *T. durum*. Its morphological characters and process of flowering are described and the methods of cultivation given.
Selection has been undertaken to improve the yield with excellent results.

529. SCOTT, R. C. 633.11:575.127:633.14
Wheat-rye hybrids.
J. Dept. Agric. S. Aust. 1932 : **35** : 798–99.
Hybrids of wheat and rye carried to the third generation proved of no value. The backcross progeny with the wheat parent was equally unpromising.

530. GORDON, G. S. and RAW, A. R. 633.11:575.127:633.16
Wheat-barley matings.
J. Dept. Agric. Vict. 1932 : **30** : 138-44.
Various progenies from wheat pollinated with barley pollen shewed complicated segregation, dwarf and awned types among other things appearing in very irregular ratios. No barley characters were observed however in the progeny. Similarly, on treating barley with wheat pollen, segregation occurred but no wheat characters appeared.
At the reduction division no great irregularities, beyond the presence of a certain number of univalents, were observed and the progeny had the normal 42 chromosomes. No clear case of sterility was observed. The authors however, conclude that the barley pollen has effected fertilization, the barley chromosomes being rejected from the nucleus and fertile individuals having resulted by duplication of the female chromosomes.

531. THOMPSON, W. P. and ARMSTRONG, J. M. 633.11:575.127.2:576.312.35
Studies on the failure of hybrid germ cells to function in wheat species crosses.
Canad. J. Res. 1932 : **6** : 362–73.
Chromosome counts of developing pollen in crosses of 21-chromosome x 14-chromosome wheat species shewed that gametes with intermediate numbers were formed in approximately the expected proportions. The discrepancy between the number produced and the number which functioned was therefore not due to absence of random segregation of chromosomes during reduction division.
Grains with intermediate numbers were retarded in development and this was attended by reduction in amount of cytoplasm ; the less the cytoplasm the more retarded was nuclear development.
Germination tests showed that 70—80 per cent of parental pollen germinated on F_1 stigmas as compared to 11—12 per cent only of F_1 pollen.

532. JONES, E. T. 633.13:575.242
Fatuoids or false wild oats. 633.13:575.127.2
Nature 1932 : **129** : p. 617.
The characters of articulation, basal pubescence and awn, which as characteristics of fatuoids in *Avena sativa* behave as partial recessives, in a cross between *A. barbata* (tetraploid) and *A. brevis* (diploid) behaved as partial dominants. The complex also breaks up, giving crossover types in the later generations, some of which have been shewn to be diploid. The failure to observe such crossing over in the fatuoid oats is regarded as evidence that the fatuoids have arisen by mutation rather than by chromosome aberration.

533. GURNEY, H. C. 633.14:576.312
The cytology of rye.
Aust. J. Exptl. Biol. Med. Sci. 1931 : **8** : 241–54.
A detailed description is given of meiosis in the pollen mother cells of rye. A telosynaptic arrangement of the chromosomes was clearly observed during prophase. The seven chromosomes shewed distinctive shapes and sizes during anaphase.
The probable behaviour of the chromonemata during telophase is discussed.

534. GOKHALE, V. G., BHOSEKAR, V. L. and PATWARDHAN, S. K. 633.17:575(54.7)
Improvement of Nagli (*Eleusine coracana*) in the Bombay Deccan.
Poona Agric. Coll. Mag. 1931 : **23** : 147–76 and 1932 : **23** : 205–23.
A continuation and conclusion of the paper noted in "Plant Breeding Abstracts" Vol. II, Abst. 250. The cultivation and methods of investigation are described.
As the result of yield experiments certain strains were regarded as distinctly promising.
Yield was found to be the result of the interaction of such factors as number of bearing tillers, number and size of the earheads, density of the spikelets and weight of the individual grains.
The possibility of cross-fertilization, though unlikely, is not excluded.

535. RANGASWAMI AYYANGAR, G. N. and NARAYANAN, T. R.
633.171:575.1.061.6:581.466
Inheritance of characters in *Setaria italica* (Beauv.) Part II. Anther colours.
Ind. J. Agric. Sci. 1932 : **2** : 59–61.
Evidence is presented to demonstrate the simple Mendelian relationship between orange and white anthers, the former being dominant.

536. HUSKINS, C. L. and SMITH, S. G. 633.174:576.312.35
A cytological study of the genus *Sorghum* Pers. I. The somatic chromosomes.
J. Genet. 1932 : **25** : 241–49.
The somatic chromosome number was found to be 20 in *Sorghum virgatum*, *S. verticilliflorum*, *S. vogelianum*, *S. lanceolatum*, *S. arundinaceum*, *S. sudanense*, *S. guineense* var. *involutum*, *S. caudatum*, *S. papyrescens*, *S. Cafforum* and *S. Cafforum* vars. *subglabrescens* and *melaleucum*, *S. cernuum*, *S. Roxburghii* var. *hians*, *S. Durra* and six other unnamed varieties of the species. *S. halepense*, Johnson Grass, had 40 somatic chromosomes and although a chromosome pair of a peculiar shape is readily recognized in all the other varieties investigated, it only occurs in duplicate in *S. halepense*, shewing that this form is an allo- and not an auto-tetraploid, possibly the result of an intergeneric cross. No chromosome differences were found in Dakota Amber and Black Amber, the only varieties which had been found to cross with Johnson Grass. Tetraploid and one octoploid areas were found in the root tips of diploid plants.

537. KADAM, B. S. 633.18:575.242
Mutation in rice.
Nature 1932 : **129** : 616–17.
Three variant plants were observed in a hybrid culture. The mutant plants had leaves and internodes of reduced length and the anthers failed to dehisce. The female gametes were apparently normal.

538. LORD, L. 633.18:581.162.32
A preliminary study of natural cross-pollination of rice in Ceylon.
Ann. Roy. Bot. Gdn. Peradeniya 1932 : **11** : 339–42.
Investigation of two " 6—6½ months " pedigree selections of rice, one with red testa colour (dominant), the other with white, at Peradeniya (altitude 1500 feet ; rainfall 89 inches) shewed 0·67 per cent natural crossing.
A similar investigation conducted in two series at Anuradhapura (altitude 295 feet ; rainfall 55 inches) with three " 4-month " selections differing in glume colour and in presence or absence of awns, revealed 0.34 per cent crossing for the first series, and 0·39 per cent for the second.

539. ROBERTSON, H. F. 633.18–1.421
Fisher's analysis of variance with paddy on a field-scale.
Ind. J. Agric. Sci., 1932 ; **2** : 53–58.
This is a case of another conversion of a field-experimentalist to the methods designed by R. A. Fisher. A description is given of a particular experiment, and the results are worked out following the treatment of Maskell and of Fisher and Wishart. Rather surprisingly the results are left with a statement of treatment means and their standard error, and no attempt is made to interpret the very significant result in terms of the individual differences between treatments. To obtain a significant result is but the beginning, and what the experimentalist is interested in is to be told in simple language of the results of the trial. It is interesting to note, however, that " in 1931 all new experiments have been laid down " according to the new methods.

540. LUNDEN, A. P. 633.491:575.11.061.6:581.46
Notes on the inheritance of flower and tuber colour in the potato.
J. Genet. 1932 : **25** : 339–58.
Flower colour is of value in classification. Three main colour groups were recognized, white, red and reddish purple, blue and bluish purple.
A family of 189 plants was obtained from Centifolia by self-pollination. Tuber colours in this progeny shewed the presence of 2 complementary factors A and B for red colour, B alone giving reddish yellow, the absence of B giving white. The first group also all had purple flowers, the second and third groups white flowers.
Crossed with King George V, a white variety, Centifolia gave coloured and white tubers approximately in the ratio 1 : 1. Some of the coloured plants were of the yellow tuber type and the flowers were in a ratio of 7 coloured to 9 white. King George V is supposed to be heterozygous for 2 factors of the A type, A and A′, at the same time being double recessive for B. The progeny from self-fertilization of the hybrids supported this view.
The variety Sagerud was also crossed with Centifolia and found to contain a factor P which together with A and B gave bluish purple tubers, stem and flowers and with B alone light purple tubers and stem and light blue flowers. The numerical results shewed that the factor was heterozygous. These later results confirmed the fact that inflorescences are free from pigmentation only in the absence of A.
Worked out in a similar way Early Puritan proved to have the constitution aaA′a′bb and Golden Lass (which has green inflorescences) aaa′a′bb ; the latter gave a certain number of coloured flowers in the white tuber group and is supposed to contain a further factor F in the heterozygous condition, which is without effect on anything but the flower.
Hindenburg on selfing proved to be heterozygous for the A and the F factors and also for a factor G, all 3 of these factors being necessary for flower colour ; the selfed progeny contained 9 coloured : 7 white flowers. The tuber colours of the progeny of Hindenburg x Centifolia further shew that Hindenburg has the constitution Aaa′a′bb and Centifolia Aaa′a′BbffGG. This interpretation is being further tested by selfing 3 of the hybrids with red tubers and 1 with white tubers and red flowers. The latter segregated in a ratio of 3 coloured : 1 white, which is one of the ratios expected.
Selfing Richter's Jubel indicates that it has the constitution AaA′a′Ff, both A and A′ acting as complementary factors to F. This was borne out by crosses with Sagerud, Kerr's Pink, Edzell Blue, Early Puritan, all having white flowers and Gratiola, heterozygous for F and A or A′. Crosses of Richter's Jubel with Louis Botha indicate that the latter contains 2 distinct factors of the P type, P and P′, in addition to F, all in the heterozygous state. The results fit this assumption.
The variety Arnica seemed to be homozygous for all flower colour factors.

541. McIntosh, T. P. 633.491:576.16
The origin of the potato.
Gdnrs.' Chron. 1932 : **91** : 279–80.
A very brief resumé of the recent Russian conclusions on the subject.

542. Justesen, S. H. 633.491.00.14–1.421
Influence of size and shape of plots on the precision of field experiments with potatoes.
J. Agric. Sci., 1932 : **22** : 366–72.
Kalamkar, R. J.
Experimental error and the field-plot technique with potatoes.
Ibid 373–85.
These are studies, using the same statistical method, of the data of two uniformity trials carried out at Ormskirk and Saskatchewan respectively. A unit size of plot was chosen, consisting of a single row of given length, and by aggregating in various ways the variation between plots of varying size and shape was determined. The method represents an advance on the technique hitherto employed, in that the error was determined from the variation within blocks of a fixed number of plots, as would be the case in an actual experiment. Further, account was taken of the amount of land used by calculating a quantity called the efficiency, and the effect of border rows was shown in a series of calculations in which these were discarded. The results were closely similar in both cases ; the best size of plot appeared to be 1/50 acre, and the best shape the long and narrow, in the form of two long rows. Competition between adjacent rows was shewn to exist, and with border rows discarded the four row plot proved to be more efficient than the three row plot, owing to the greater proportion of the area used. With the size suggested as the best the standard error of a single plot was about 5 per cent of the mean yield.

543. Gopalaratnam, P. 633.51:575.061.633
A chimera in cotton.
Madras Agric. J. 1932 : **20** : 151–52.
A variegated plant is described. Seeds from the mottled section gave some green and some cream seedlings, the latter died immediately.

544. Hutchinson, J. B. 633.51:575.11.061.6:581.466
Cotton notes.
Trop. Agriculture 1932 : **9** : 126–27.
A review of papers by Kottur and others, in which the reviewer puts his own interpretation on some of the results.

545. Harland, S. C. 633.51:575.115
Genetics of cotton. Part V. Reversal of dominance in the interspecific cross *G. barbadense* Linn. x *G. hirsutum* Linn. and its bearing on Fisher's theory of dominance.
J. Genet. 1932 : **25** : 261–70.
In Sea Island cotton, normal and Crinkled Dwarf have been shown to form a simple pair of allelomorphic characters with normal dominant. Three crosses, using Crinkled Dwarf as one parent, are here described.
(1) Crinkled Dwarf with other Peruvian types.
(*a*) C. D. x Red Kidney. The F_1 showed slight traces of crinkling ; back-crossed on to crinkled the usual 1 : 1 ratio was obtained.
(*b*) C. D. x G. W. P., a Peruvian type of Marie Galante. The F_1 showed very faint traces of crinkling ; the F_2 showed normal segregation.
(*c*) C. D. x Enan's Brown Egyptian. Results similar to (*a*) and (*b*).
(*d*) Egyptian Wrinkled Leaf x Sea Island. This cross and a cross, Crinkled Dwarf x Wrinkled Leaf, proved the two characters to be identical.
Dominance, in these cases was only complete in the cross between C. D. and the form from which it originated.
(2) Upland x Crinkled Dwarf.

The F_1 was uniform and practically intermediate ; in the F_2 a complete gradation from normal to a crinkled form more extreme than the parent was obtained. The F_1 back-crossed to Upland gave an excess of normals with gradations rendering determination uncertain. In addition to details of the progeny of the first back-cross, those for the second, third and fourth back-cross to Upland are given. In all these Crinkled and normal appear with a ratio approximating to 1 : 1.

(3) (*a*) Crinkled x *G. sturtii* (a 13 chromosome species).

The F_1 were all uniform and strongly crinkled but completely sterile.

(*b*) (Crinkled x Peruvian Normal F_1) x *G. sanguineum* Hassk.

The Peruvian F_1 parent showed very slight traces of crinkling and the single plant obtained showed the crinkled character slightly but more intensely than the female parent.

The earlier of these results were communicated to Fisher who adduced them in support of his theory of dominance and in this paper the author concludes with a discussion of the bearing of his full results on that theory and the alternative theory put forward by Wright.

546. HARLAND, S. C. 633.51:575.127.2

Fertility in hybrids between New and Old World cottons.

Nature 1932 : **129** : 398–99.

Certain hybrids between Old and New World cottons have recently been obtained by using the latter as female parent and some of the hybrids have proved to have some functional pollen grains. The F_1 hybrids were mostly intermediate between the parents.

Backcrosses were made to the female parent *Gossypium barbadense* and the plants obtained shewed great reduction in colour intensity of the organs influenced by the Asiatic gene R, indicating that the New World species lacked the modifiers necessary for the full manifestation of this gene. Several seedlings were also obtained from the second backcross and the fertility is greatly increased.

547. HUTCHINSON, J. B. 633.51:575.127.2:575.113.4

The genetics of cotton. Part VII. " Crumpled " : A new dominant in Asiatic cottons produced by complementary factors.

J. Genet. 1932 : **25** : 281–91.

The " crumpled " form first appeared in the cross *G. arboreum var. sanguinea* x (*G. arboreum var. sanguinea* x *G. Nanking var. soudanensis*). Of the 90 plants obtained 46 were " crumpled," the intensity of the " crumpled " character varying greatly from plant to plant. The results obtained from selfing and back-crossing fit the supposition that the " crumpled ' form arises from the association of two complementary factors, one being carried by each of the parents. A second strain of *G. arboreum var. sanguinea* was shewn to lack the complementary factor. One factor has been found in two strains of *G. Nanking var. soudanensis*, the other in 17 varieties of *G. arboreum*, *G. Nanking*, *G. herbaceum*, *G. obtusifolium* and in a strain of *G. Stocksii*. It is noteworthy that this is the first example of a gene common to the Asiatic *Gossypiums* and *G. Stocksii*.

Interest centres in the differential intensity of expression of the character " crumpled " which, in extreme cases, takes the form of empty seeds or shrivelled embryos. Such extreme forms, if they stood alone, would be interpreted as cases of inter-specific sterility and it is suggested that this is actually the explanation of some of the observed cases. It is also pointed out that the intensity of expression accords with taxanomic evidence in placing *G. Nanking var. soudanensis* nearer to *G. arboreum* and *G. Nanking* than to *G. herbaceum* and *G. obtusifolium*.

548. HARLAND, S. C.. 633.51:575.127.2:575.113.5.061.6

The genetics of cotton. Part VI. The inheritance of chlorophyll deficiency in New World Cottons.

J. Genet., 1932 : **25** : 271–80.

Stroman and Mahoney first drew attention to the occurrence of chlorophyll deficiency in the F_2 between Upland and Sea Island or Egyptian. Segregation gave a 15 : 1 ratio. Evidence of a third factor was obtained and, in Texas, a form known as virescent yellow has been studied and found to be a simple recessive to normal.

In the material studied by the author there was considerable variability in the amount of chlorophyll present in the cotyledons, and a number of deficients were carried to the mature stage by grafting on to normal stocks. Two generations of selection for viability gave rise to a pure chlorophyll—deficient race in which most of the seedlings were capable of arriving at maturity without grafting or special treatment. It has been termed Type 5. This type is crossed with the following :—

(1) Upland, five types
(2) Peruvian three types
(3) Polynesian Wild, *G. tomentosum* Nutt.

(1) (*a*) Type 2 (Superokra) x Type 5. F_1—F_3 and back-crosses show a simple pair of allelomorphic characters, which are represented by Chb—chb.
(*b*) Type 34 (Guatemala khaki) x Type 5. F_1, F_2 and back crosses indicate that two independently inherited factors for green occur in Type 34 while the identity of one of these factors with that of Type 2 can be deduced from the fact that no crosses between various types of Upland have given chlorophyll deficient offspring. Type 34 is Chb, Chb, Chc, Chc.
(*c*) Similar tests with several other types of Upland shewed either a mono- or bi-factorial inheritance. The factor Chb appears to be common to all types ; the factor Chc is homozygous in Type 34 but heterozygous in Types 7 (Texas Green Lint), 9 (Meade) and 19 (Punjab Golden).
(2) (*a*) Crinkled Dwarf Sea Island x Type 5. The cross shewed a monofactorial difference which, for reasons given, is not the same as either of the two characterizing Upland and may be termed Cha.
(*b*) Red Kidney x Type 5. Progeny to the F_2 and back-crosses indicate a single factor and the same as in (*a*), Cha.
(3) A back-cross of the F_1 x recessive gave a 3 : 1 ratio. Subsidiary crosses with Peruvian and Upland types shew the constitution of *G. tomentosum* to be ChaChaChbChb and interest attaches to the fact that it possesses one Upland and one Peruvian gene.
Confirmatory evidence is derived from a number of crosses between Type 5 and the F_1 of Upland x Peruvian crosses. They indicate that the normal green colour in the New World cottons is dependent on three factors provisionally set forth as follows :—

Peruvian Group	ChaCha.
Upland Group	ChbChbChcChc or ChbChb.
G. tomentosum	ChaChaChbChb.

The type of chlorophyll deficiency here studied differs from those previously described in that it occurs only in interspecific crosses and is profoundly affected by modifiers which enable the selection of a viable race. The variability of the expression of the character, enabling it to be classed into nine grades, is traced to modifiers and the results are compared with those for *Brassica* obtained by Kristofferson and for *Drosera* referred to by Fisher.

549. Brown, C. H. 633.51:575.42:578.08
The purity chequer in cotton-breeding.
Emp. Cott. Grow. Rev. 1932 : **9** : 119–25.
A method of testing the purity of a strain by plotting correlation diagrams for two characters on squared paper. In this way strains with the same mean value as the bulk but with greater purity are retained as the type and any plants deviating in a desired direction are retained as selections.

550. Venkatraman, T. S. and Thomas, R. 633.61:575.127:633.174
Sugarcane-sorghum hybrids. Part I. General outline and early characters.
Ind. J. Agric. Sci. 1932 : **2** : 19–27.
The methods of producing the hybrids are described.
Early maturity was one of the chief desiderata in making the cross and over a dozen of the hybrids matured in from 5 to 6 months, giving a satisfactory juice composition, as is shewn by the tabulated figures and agricultural characters. The plants were capable of vegetative propagation as the sugarcane and in most respects resembled sugarcane more than the sorghum parent. Various sorghum characters, however, were observed, in proof of their hybrid origin.

Various of these characters are passed in review.
Owing to poor early root development many of the hybrids died in the early stages ; others on the other hand were quite good in this respect. The hybrids had lower water requirements than sugarcane.
The variation in all characters was much greater than in crosses between two cane varieties.

551. EDEN, T. 633.72.00.14
Studies in the yield of tea. II. The seasonal and sampling variation in yield and mineral composition of the tea leaf.
J. Agric. Sci., 1932 : **22** : 386–95.
The data for this investigation consist of samples from four half-acre blocks for 35 consecutive pluckings over 17 months corresponding to the second half of the three year pruning cycle. Statistical analysis shewed significant variation due to seasonal differences for all constituents, and to block differences for all except nitrogen and phosphorus. These results shewed the sampling technique to be satisfactory, and the standard of plucking to have been maintained at a high level. All characters except ash shewed long period fluctuations associated in a general way with the weather cycle, although the investigation is not very detailed on this point, and a moderate correlation found to exist between yield and nitrogen content is not further examined in relation to the weather changes.

552. SMITH, E. H. G. 633.855.34:575.42
The oil palm (*Elaeis guineensis*) at Calabar.
8th Ann. Bull. Agric. Dept. Nigeria, 1929 : 5–42.
The various types are described and the individual yields given for a number of palms, from which it is evident that a large number of the palms are definitely inferior yielders.
The best palms have been self-fertilized. The method of pollination is described in some detail.
The trees selected on the basis of yield were subjected to a rough field analysis of the percentage of mesocarp, coarse fibre, shell and kernels and the best of these were retained.

SMITH, E. H. G. 633.855.34:575.42
The oil palm at Calabar.
Bull. Dept. Agric. Gold Coast 1930 : **20** : 181–208.
Also 2nd Conf. W. Afr. Agric. Officers, 1929.
An abridged account of the paper (see preceding abstract) published in the 8th Annual Bulletin of the Agricultural Department, Nigeria, 1929.

553. OSBORN, J. B. 633.879:575.42
Seed selection of black wattle (*Acacia mollissima*).
Emp. For. J. 1931 : **10** : 190–202.
Variation between individuals has been observed with regard to vigour, shape and other characters of the trees and in bark thickness, which influences the total yield of bark. The trees with the thickest bark also have a higher tannin content.
Progeny tests of a number of open-pollinated trees have been made, comparing them with a commercial variety. Some of the progenies have been very uniform, others heterogeneous ; some have been of a very desirable type in respect of vigour, form and foliage and disease resistance (including " frog-hopper ").
Various recessive characters appeared in the progenies. This indicates a certain degree at least of self-pollination in the parent trees.
Considerable improvement is expected from selection.

554. CRANE, M. B. and DARLINGTON, C. D. 634.71:575.116.1:576.356.5
Chromatid segregation in tetraploid *Rubus*.
Nature 1932 : **129** : p. 869.
Results observed are compared with those expected on the assumption of random segregation of chromosomes and the random segregation of chromatids. The results agree with the latter and differ significantly from the former hypothesis, so supporting the chiasmatype hypothesis of crossing over.

Part II. Foreign

BIBLIOGRAPHY 016

555. WELLENSIEK, S. J. 016:581
Statistical data regarding the botanical literature of 1930 with a general discussion.
Rec. Trav. Bot. Néerland. 1931 : **28** : 281–96.

The number of papers appearing in the different branches of the subject, including Genetics as one branch and Plant Breeding as another, and the number in each language, with a number of other interesting data are given.

The author calculates that taking the Plant Breeding division alone, in which 208 papers with a total of 4,025 pages are noted, the reader would have to cope with over eleven pages a day.

A number of very useful suggestions for increasing the ease with which this mass of literature can be followed is given. Among these are the use of English, the reduction or abolition of annual reports and similar inconvenient and inefficient means of publication and the increased use of abstract journals.

GENETICS 575

556. SAX, K. 575.116.1
The cytological mechanism of crossing over.
J. Arnold Arb. 1932 : **13** : 180–212.

Various theories are discussed and criticized. The writer's own theory is offered in explanation of the reduction in crossing over which accompanies non-disjunction and of certain other phenomena difficult to reconcile with other theories.

In the writer's theory crossing over is supposed to result from breaks in two of the chromatids at a chiasma. This is regarded as an explanation of the reduction in the number of chiasmata between the diplotene and metaphase stages.

557. SCHIEMANN, E. 575.12:581.2
Die Bedeutung der Experimentellen Genetik für die Botanische Systematik.
(**The importance of experimental genetics for systematic botany.**)
Naturwissenschaften 1932 : **20** : 145–50.

The great advance that was made in the phylogenetic treatment of systematics after the establishment of genetics as an independent science is emphasized.

The contribution of genetics to the study of the diversity of the plant kingdom is first discussed ; genetics is applied to the ever-increasing wealth of known material by Johannsen's method of variation statistics and the Mendelian method of gene analysis—by pure breeding the systematist must come to distinguish the genotype from the phenotype.

The light which analytical genetics has thrown upon the nature of the species is pointed out, also on the origin of forms, by the recombination of genes already present, by new genes arising by mutation—which accounts for polymorphism within the species,—by chromosome alterations, polyploidy, irregularities resulting from interspecific and even intergeneric crossing. Various factors which may help to keep forms or species separate are enumerated. These studies, besides shewing the important part played by hybridization in evolution, have helped to explain and demonstrate the reality of the Linnean species.

The geographical study of species and forms has indicated the part which natural selection has played in their origin and adaptation—formation of ecotypes.

558. YASUI, K. 575.127.2:576.31
Cytological studies in artificially raised interspecific hybrids of *Papaver*
III. Unusual cases of cytokinesis in pollen mother-cells in an F_1 plant.
Cytologia 1931 : **2** : 402–19.

A description of some unusual types of cytokinesis in which special attention is paid to the formation of the middle lamella.

559. HERIBERT NILSSON, N. 575.243
Über die induzierte Mutabilität. (**Induced mutation.**)
Hereditas, 1932 : **16** : 341–57.
A continuation of the discussion referred to in " Plant Breeding Abstracts " Vol. II, Abst. 23 and 380. The author here shews that whereas the survival rate of the normal is greater than that of the mutant under normal conditions, the reverse is sometimes true under the extreme conditions of the experiment.

560. HERTWIG, P. 575.243
Die künstliche Erzeugung von Mutationen und ihre theoretischen und praktischen Auswirkungen. (**The artificial induction of mutations and its theoretical and practical results.**)
Z. indukt. Abstamm.–u. VererbLehre. 1932 : **61** : 1–35.
The author discusses much recently published research on the artificial production of mutations by chemical agents, the production of known and unknown genes by X-rays and radium induced mutations, by the more recent and very important method of abnormal temperature. The idea that induced mutations are secondary effects from some change in the plasma is now abandoned and there has now been established a direct relationship between the degree of ionization for a given ray and the mutation rate. Although germinating seeds, hence with cells in rapid division, are more susceptible to induced mutation than resting seeds, yet pollen cells, ovaries and other sex cells are also highly sensitive.
Certain genes are particularly sensitive to radiation, others, or sometimes the same genes, are sensitive to temperature effects.
Clear differences exist between species and races in susceptibility to mutation, polyploids being especially refractory. Individuals may apparently also exist with duplicated genes in the haploid number of chromosomes.
In the discussion of the significance of the phenomena the author emphasizes the correspondence between natural and induced mutations, in almost all respects. This signifies, in the author's opinion, not that the stimuli producing mutation in nature are similar to those used in the experiments, but that the gene has an inherent capacity to react in an identical way to a number of different stimuli.
The occurrence of reverse mutations and similar phenomena leads the author to regard mutation as some sort of alteration of the constitution of a gene rather than its loss or inactivation. Jollos's observations of gradational mutations always from dominant to recessive in heat mutations, however, may ultimately be of significance in this respect.
Next are discussed very briefly the genom or whole chromosome alterations which result from the same stimuli and the bearing of both types of mutation on the theory of evolution. The occurrence of new types is significant in this respect only in so far as they are better suited to the environment. Essentially the same applies to the breeder, who must search amongst thousands of possibly worthless mutants for one which may be of extreme value.

561. STUBBE, H. 575.243
Untersuchungen über experimentelle Auslösung von Mutationen bei *Antirrhinum majus* III. (Die Erhöhung der Gen-Mutationsrate nach Röntgenbestrahlung, Bestrahlung mit ultraviolettem Licht, Temperaturschocks, nebst einigen Bemerkungen über die in diesen Versuchen induzierten Variationen). [**Investigations on the experimental production of mutations in *Antirrhinum majus* III. (The raising of the gene mutation rate by the use of X-rays, ultra-violet light, temperature shocks, with some remarks on the variation induced by these experiments.)**]
Z. indukt. Abstamm.-u. VererbLehre. 1932 : **60** : 474–513.
The mutation rate for the control material is reckoned as about 1·0 per cent and the rate of variation as 0·13 per cent.
Grenz rays increase the mutation rate by about 300 per cent and the number of variations is increased by several hundred per cent. The mutation rate is increased by X-rays by about 400 per cent and the number of variations by about 350 per cent above the normal.

The mutation rate increases with the dosage but not the number of variations. The effect of the rays is much greater on the vegetative parts than on the flowers. A comparison between the effect of the same dosage in male and female gametes shewed an increased mutation rate in the former. The reverse was true for variation.
Ultra-violet light and temperature shocks had no effect.
It is shewn that two mutations may take place in one male gamete.
Reverse mutation to the normal form also occurred in some mutants. Ten cases were found in which there was a homozygous recessive mutation. The possible ways in which this might occur are discussed.

562. BAUR, E. 575.243:578.088.1
Der Einfluss von chemischen und physikalischen Reizungen auf die Mutationsrate von *Antirrhinum majus*. (**The influence of chemical and physical stimuli on the mutation rate of** *Antirrhinum majus*.)
Z. indukt. Abstamm.-u. VererbLehre. 1932 : **60** : 467–73.
The control line without stimuli has in the last year mutated in 9 new factors, a percentage of 1·15 mutants, the treated plants shewing a corresponding rate of 3·7 per cent. The percentage in an F_2 from one of these F_1's from treated parents was 2·1, in the following generation 1·7 and in the F_4 fell to 0·35 per cent.
The majority of these mutations are recessive factors already known as spontaneous mutations. Two dominants have appeared both in the F_1, whereas dominants have not yet appeared spontaneously.

CYTOLOGY 576

563. LEWITSKY, G. A. 576.312.32
(Review of investigations performed at the Cytological Laboratory of the Institute of Plant Industry in U.S.S.R.)
Bull. Appl. Bot. Genet. and Plant-Breed. 1931 : **27** (1) : 9–17.
Studies of the nuclear condition in the *Gramineae* have revealed the widespread existence of polyploid series within the genera.
Much more fundamental is the change of the basic number from 12 to the lower numbers 7 and 5 characteristic of the most highly evolved graminaceous groups, side by side with an increase in chromosome size.
Fundamental alterations of the systematics of the *Gramineae* have resulted from much of this research.
The morphology of the chromosomes has also been found characteristic for various groups, this apparently representing a more recent evolutional change. The bearing of this on systematics was investigated and conclusions based on the study of the sub-family *Helleboreae*, the genera *Vicia* and *Aegilops* led to the conclusion that chromosomal differences do not correspond directly to systematic differences, being more pronounced than these in some cases and less in others.
Such morphological studies of the chromosomes have shed light on the parental make-up of certain polyploid species and the artificial creation of new ones on analogous lines. Attempts have also been made to induce by means of X-rays similar alterations of the chromosome structure to those observed in nature.

564. LEWITSKY, G. A. 576.312.32
(The morphology of the chromosomes.)
Bull. Appl. Bot. Genet. and Plant-Breed. 1931 : **27** (1) : 19–174.
The literature on the subject is reviewed in detail.
In the special section the author's own work on various plants is described and illustrated. In rye considerable variation was observed in the precise size of the various chromosomes and even of the relative portions of one chromosome which possessed an appendage. One race with 16 chromosomes was examined.
In 2-rowed barley differences have been established between the geographical groups rather than between the species. Races with chromosome numbers varying from 14 to 16 have been observed here also.

In *Vicia Faba* size differences of a similar kind were observed, even between the homologous chromosomes of the same plate ; this was observed also in *Pisum sativum*. Various other plants were examined and revealed differences of the same nature.
All chromosomes seem to be possessed of 2 arms, however small. The nature of the satellites, appendages and other morphological features of the chromosome is discussed. A simple condition is shewn to be phylogenetically more primitive than the reduced and complicated chromosome forms in general, but this condition comes about sometimes gradually, sometimes quite suddenly.
By improvements of the technique such as are described in the present paper it has been possible to detect morphological differences in the chromosomes hitherto unobserved. In this way the alloploid nature of certain polyploid species (e.g. *Aegilops*) has been proved, in which the " idiogram " of one species can be traced in a whole series of polyploid species.

565. LEWITSKY, G. A. 576.312.33:582
(The " karyotype " in systematics.)
Bull. Appl. Bot. Genet. and Plant-Breed. 1931 : **27** (1) : 187–240.
Not only the number of chromosomes but also their form, when accurately studied, is of great use in systematics, possibly as valuable as the ordinary diagnosis on external characters.
According to Delaunay, the so-called " karyotype " varies from genus to genus, preserving the same general type in different species of the genus, but differing in detail—the idiogram. This question is the subject of the present deliberations.
Cases of genera are described in which definite variations in chromosome characters—e.g. their length—are associated with clear specific differences ; one other species of this genus—*Nigella*—has more pairs of one chromosome type than the others. Other genera are shewn to have slight variations in the karyotype in the different species and these deviations are shewn to correspond with peculiarities of morphology separating the species from the remaining ones on ordinary systematic grounds.
The same genus (*Delphinium*) shews other clearly defined species which do not in any way differ in their karyotype and a closely related genus (*Aconitum*) was found to correspond closely in some of its species, whilst others were definitely distinct. On the grounds of the karyotype *Aquilegia* and *Leptopyrum* are in a group apart from the other genera examined.
Symmetrical chromosomes with equal limbs are regarded as more primitive than asymmetrical ones and this is found to correspond with the primitiveness or otherwise of the species possessing them.
The long arm of the asymmetrical types is no longer, sometimes shorter, than the corresponding arm of the symmetrical species and the differentiation has apparently come about by simple shortening of the arms in question. If this is the case the degree of asymmetry can be taken as an index of the phylogenetic position of the species. Some species shew reduction in both arms but the universal occurrence of asymmetrical chromosomes seems to shew that when reduction has once begun in one arm it tends to continue in that arm. In support of this supposition is the fact here observed that the differences from one type to the other are greater in the short arm than in the long arm. That the reduction in the short arm tended to be accompanied by a reduction also in the long arm was shewn by the marked positive correlations observed between the lengths of the 2 arms.
In addition to cases in which different genera have very similar karyotypes, other genera are shewn to contain species which differ one from the other in their karyotype. In the first case the genera belong to the same tribe of the family and the karyotype becomes a tribal thing, the genera in this case differing in chromosome length, etc., as do the species in ordinary cases. In the second case the karyotypic differences quite often have no systematic significance, as in *Vicia*, *Cucumis* and especially the 16 chromosome rye which in other respects is identical with the common 14 chromosome rye. Such types have probably arisen by chromosome aberration of some sort, resulting in recombinations of the hereditary material.
It is seen therefore that the chromosome morphology in many cases is of extreme systematic value, in other cases much less so, i.e. it is relative, just as in the case of external characters. The size and basal number of chromosomes are the most fixed of the karyotypic differences,

characterizing whole tribes or families, smaller differences characterizing species or even varieties (*Beta vulgaris*). The differences in the individual chromosomes, length of arms, etc., are mostly specific or varietal and differences in polyploid series—diploid, tetraploid, etc.—are frequently only varietal or racial.
Particular differences in karyotype corresponding to particular systematic differences do not exist and here, as in other respects, it is clear that systematic differences are only made by the cumulation of small differences and not by sudden leaps.

566. LEWITSKY, G. A. and ARARATIAN, A. G. 576.312.36:537.531
(Transformations of chromosomes under the influence of X-rays.)
Bull. Appl. Bot. Genet. and Plant-Breed. 1931 : **27** (1) : 265–303.
In each of the 3 plants used—*Secale*, *Vicia* and *Crepis*—mitoses shewing the abnormalities were obtained only on the use of particular doses. Rye proved much more susceptible than the other 2 species.
Amongst other abnormalities of interest in the rye were 2 chromosomes with reduced proximal arms similar to the supernumerary chromosomes observed in 16 chromosome rye. The absence of chromosomes with appendages in this line indicated that it was this pair which had suffered the loss. Numerous other cases of fragmentation, etc., are described and illustrated. These result in headed chromosomes in place of normal 2-armed ones and other such anomalies.
Similar anomalies were observed in *Vicia sativa*, together with the apparent attachment of a portion of one headed chromosome to its homologue, producing a large V-shaped chromosome. This was observed also in *Crepis capillaris*, with more certainty on account of the clear distinction between the 3 chromosome sets in this species. The various types of abnormality observed in this species are enumerated. Amongst these were cases of the union of 3 distinct chromosomes. The occurrence of translocations was also proved by direct measurement of the chromosomes concerned.
There is evidence that at times a fragment may develop an attachment constriction. The origin of new chromosomes, bearing typical satellites, has been observed.
The chromosome irregularities here described did not arise immediately after irradiation but apparently as a result of some train of reactions within the cell following upon irradiation.
Such phenomena have occasionally been observed in nature and may have played a considerable part in the evolution of new karyotypes.

BOTANY 581

567. YASUDA, S. 581.162.52
On the special substance that inhibits self-fertilization. Physiological consideration on its nature based on the results of the experiments on the fertility of *Petunia violacea*.
Bot. Mag. Tokyo 193? : **46** : 225–31.
A brief review of the author's work in which he shews that the styles of self-incompatible individuals contain a special substance which inhibits the growth of pollen from the same plant ; in other cases the substance is in the styles and in some cases only in the ovary. The substance is produced in the ovary and the point at which it is encountered by the pollen tube depends on how far it diffuses up the style.
The substance is produced abundantly only in the middle of the flowering season and this accounts for the increased fertility of flowers pollinated early or late (end-season fertility). In fact it is produced in quantity only when the plant is vigorously growing, becoming less at reduced temperatures.
The substance accelerated cross-fertility.

568. WÓYCICKI, Z. 581.321.2:575.73
Cytolyse bei *Nicotiana* und *Larix*. **(Cell degeneration in *Nicotiana* and *Larix*.)**
Acta Soc. Bot. Polon. 1931 : **8** : 1–17.
Degeneration of the pollen mother cells might be preceded or followed by a degeneration of the cells of the tapetal layer in the hybrids of *N. silvestris* x *N. atropurpurea*.

In some cases the cells of the tapetal layer increased in size, their protoplasm became disorganized, the cell walls broke down and they threw out a kind of plasmodium which surrounded and destroyed the pollen mother cells.
A similar phenomenon could be observed in the anthers of *Larix dahurica* when treated with ether.

AGRICULTURE 63

569. 63.00.15(43.7)

Agricultural research in the Czechoslovak Republic.
Rep. Inst. Agric. Res. Czechoslovak Rep., Praha, 1931 : **48** : 40 pp.
A booklet giving a full account of the organization of agricultural research in the Czechoslovak Republic.

ECONOMIC PLANTS 633

570. Bukasov, S. M. 633(72 +72.81 +86)
(The cultivated plants of Mexico, Guatemala and Colombia.)
Suppl. 47 Bull. Appl. Bot. Genet. and Plant Breed. 1930 : 553 pp.
The countries of Central and South America are the birthplace of numbers of cultivated plants unknown to the Old World before the discovery of America. Many have since been introduced, but frequently only chance samples of one or two plants have served for this, whilst in the countries themselves the varietal diversity is immense and the field for selection would seem unlimited.
These plants have arisen apparently in eight centres in tropical America, three of these being located in the regions under present investigation, viz., Mexico, Guatemala and Colombia. The regional distribution is discussed in relation to each crop in turn. For maize four zonal groups were established—*amylacea* with the centre in Colombia and Peru, *indurata* in Central America, *indentata* and *everta* in Central America. In addition to the three latter groups, teosinte is also centralized in Central America and Mexico and natural hybrids between the two are found. The *indurata* group is nearest to teosinte and Guatemala may be regarded as the maize centre.
A final decision as to the centre of origin of *Phaseolus* cannot yet be made but the Mexico-Guatemala centre so far seems to contain the maximum number of forms.
The Central American group of cottons (including Upland) are assigned to Mexico and Guatemala, in the lower, tropical regions. The centre of the South American group is less defined and it seems possible that it may have been taken into cultivation independently by the Chibcha and the Inca civilizations.
Wild and native cultivated species of potato with 24, 36, 48, 60 and 72 chromosomes were found, including certain new species which give fertile hybrids with the European cultivated varieties and are at the same time resistant to *Phytophthora*. The most widely distributed of the native species is *Solanum andigenum* and the most primitive forms of this and other species are found in central Peru. Mexico, on the other hand, contains the greatest number of wild species. A great number of tuberous species was found and detailed descriptions of these are given. Most of them set seed and cross-pollination in the field even occurs.
Amongst others, hennequin and cacao have centres in central America, pulque agave and *Nicotiana tabacum* in central Mexico, sunflower and Jerusalem artichoke in North America.
The characteristics of the various countries included in the expedition are described in turn.
The crops are then treated in turn, starting with maize, which is discussed in a special supplement by N. N. Kuleshev. The material collected displays an immense wealth of forms and variability of characters, and in particular of transitional forms, to such an extent that the present systematic divisions are destroyed entirely. Even samples of sweet corn were found, in other respects not differing from the local varieties.
The same conditions obtained for the various species of *Phaseolus*, the second most important crop in native agriculture. Over 1000 different varieties were collected, representing an extreme wealth of types, some were of value for immediate cultivation and many others for use in breeding.

Many new, especially dominant, characters were observed and homologous series of characters in the different species. Twelve geographical groups are described, the grouping shewing a close correspondence in the different species. As many as 246 forms were found in Mexico, some of them endemic. At the same time Mexico contains the largest number of wild species, including endemic species.

Descriptions are given, with indications of the distribution, for various other plants cultivated for their tubers—cubio, ulluco and oka, which only develop tubers in reduced length of day. This militates against their use as potato substitutes. There follow similar descriptions for manihot, sweet potato, arracacha, all ancient crops of Latin America, and the latter on account of its high starch content and attractive flavour, a very desirable plant for introduction, if a suitable climate could be found for it.

Capsicum species are very frequent and various, dating back to very ancient times, few wild forms having remained. There are apparently two centres of diversity, Mexico and Brazil. The different species, and even the varieties of the same species, have different and rather clearly defined centres of diversity. The different varieties and forms of *C. annuum* are described.

There are very few indications of the native cultivation of the tomato and it seems to have been used in the form of wild plants. The cultivated forms collected belonged to four species of *Lycopersicum*, which are described in a special supplement by N. I. Mazkievicz. Many new varieties and forms were observed, differing markedly from the European cultivated varieties; more than 200 sorts of *L. esculentum* were collected.

In native agriculture a much greater place is taken by *Physalis* (*Solanaceae*) than the tomato, with which it was often confused in the old literature; large numbers of varieties and forms of various species of it were collected, embracing both wild forms and many forms cultivated by the natives.

Of cultivated cucurbits a great variety was found, most of all in Mexico, and a special supplement by N. E. Zhiteneva is devoted to them. *Cucurbita Pepo* is thought to have had its centre in Canada and the U.S.A. and is rarer in Mexico and almost absent in South America. On the other hand *C. moschata* shews the greatest diversity of forms, including many endemics, reaching a maximum in Mexico and Guatemala, where it is thought to have originated and passed into South America.

C. maxima is absent in these countries. Certain previously unknown types, with characters both of *C. moschata* and *C. Pepo*, were ascribed to a new species, *C. mixta*, whose distribution coincides with that of *C. Pepo*. It crosses with both these species and is possibly a natural hybrid.

All the cucurbits from tropical America differ from the Asiatic ones in vigour of growth, hard skin and lateness. Certain specimens of *C. moschata* with more tender skin and earlier were found in Mexico from which the forms in common cultivation in northern countries might have arisen.

C. ficifolia occupies a very wide area, with a probable centre in Mexico.

The plant *Chayota edulis*, which furnishes edible fruits and starchy roots, seems capable of introduction into countries too hot for the potato.

Of oil plants, *Salvia Chia*, found in Mexico and Guatemala, is of interest in providing oil which is valued above linseed oil. The seeds ripen in the warmer parts of Europe.

Agave is a plant of very ancient cultivation in Mexico and Central America. Some are used for preparing alcoholic beverages as well as fibre (*A. atrovirens*, *A. tequilana*); although they produce abundant seeds they are propagated mostly vegetatively. Sisal is a crop of primary importance, especially in Yucatan; it was an endemic cultivated plant in the maya civilization.

Descriptions are given of a number of other ancient cultivated plants of these regions, e.g., tobacco, cacao, various sapotaceous fruits, papaya, pineapple, avocado, guava and many others. The centre of origin of the fruit bearing cactus is in the Mexican plateau and many forms are described.

A special supplement by F. M. Mauer is devoted to cotton. Mexico presents an immense varietal diversity of the "New World group," both in morphological characters and physiological and ecological characters, including a large number of forms of extreme agricultural and commercial value, such as forms with very large bolls, high yield and long lint which are found both among the annual and the perennial types. The annual forms with long photoperiod from central Mexico closely correspond to cultivated sorts of the type Acala, Durango, etc.; they are usually

very impure and some of them appear to be hybrids. Many of the forms are of value for immediate introduction or after selection or use in hybridization. They mostly belong to *G. hirsutum* (Central American group) and cross with ease with the Uplands. All modern cultivated Uplands are thought to have originated in Mexico. Extreme differences in reaction to different lengths of day were observed.
In Colombia the South American type (*G. barbadense*) occurs in addition to the central American type and hybrids between them. Sea Islands with large bolls, of great value for hybridization have been found.
The varieties and forms occurring are described.

571. Posthumus, O. 633:575
On international co-operation of selectionists in tropical countries.
Bull. Assoc. Internat. Sélectionneurs Plantes 1931 : **4** : 226–35.
The international relations between plant breeders, stopped by the war, have been renewed in the tropics by a number of organizations who are concerned with the problems connected with tropical crops. These are independent of similar organizations in the temperate zones.
The hope is expressed that the International Association of Plant Breeders may establish contact with these other associations and so prove itself a truly international organization.

572. Christiansen-Weniger, F. 633:575(49.6)
Zweiter türkischer Pflanzenzüchterkongress vom 20–28 Februar 1932. (**The second Turkish Plant Breeding Congress, February 20–28th, 1932.**)
Der Züchter 1932 : **4** : 110–12.
A brief account of the organization of the plant breeding in Turkey.
The natural conditions of the country make it necessary to decentralize the breeding in regional stations which breed types adapted to each different ecological region. Various stations concerning themselves with special problems have been established therefore, e.g. Adana—cotton breeding, Adapazar—maize and potato breeding, Ankara—breeding for winter hardiness, Eskischehir—breeding cereals for resistance to disease and drought, Yeschilköy—quality tests in wheat and barley and breeding for rust resistance.

573. Boonstra, A. E. H. R. 633:575:581.1
Physiologie en veredeling van landbouwgewassen. (**Physiology and plant breeding.**)
Vakbl. Biol. 1931 : **13** : 21–27.
In a brief outline of the methods of cross breeding the author points out that nothing is known as to which characters are most responsible for the determination of the yield of our cultivated plants and stresses the need for detailed knowledge of these individual characters. Only in this way will it be possible to choose the most suitable parents for breeding new races with particular properties.
To attain this knowledge it is necessary to enquire what physiological processes underlie small differences in ear number, grain weight and the like, the solution of which is to be found in the study of the young plant, varietal comparisons during the growing stages, root studies and the like. The author has observed differences in absorption capacity per unit root surface between two nearly allied cereal varieties, also differences in length of life of the leaves.
A knowledge of each of the individual factors making for high yield would probably make it possible to make combinations with yielding capacities unknown at the present time.

574. Schribaux 633:575:608.3
La protection de la propriété des nouveautés végétales au point de vue national et international. (**The legal protection of new vegetable discoveries from the national and international point of view.**)
Bull. Assoc. Internat. Sélectionneurs Plantes 1931 : **4** : 197–218.

BUSSARD, L.
La protection de la propriété des nouveautés végétales. (**The protection of the ownership of new vegetable discoveries.**)
Ibid. 236–41.
BOHNE, W.
Kurzer Auszug aus dem Vortrag von W. Bohne über " Stand des gesetzlichen Schutzes der Pflanzenzüchtungen in Deutschland " auf dem Internationalen Pflanzenzüchter-Kongress Juni 1931 zu Berlin. (**Short extract from Mr. W. Bohne's report on " The position of the question of protection by German laws of bred plants," given at the International Congress of Plant Breeders in Berlin during June 1931.**)
Ibid. 304–05.
STEERE, L. V.
The American plant patent law.
Ibid. 321–24.
TOURNEUR.
Rapport presenté par MM. Tourneur frères sur la protection des nouvelles obtentions de plantes de grande culture. (**Report made by Messrs. Tourneur Brothers on the protection of new discoveries made in plant breeding.**)
Ibid. 328–30.

M. Schribaux emphasizes the need for the extension of patent rights to plants. He gives a brief summary of the measures in force in other European countries and draws up a scheme of the conditions under which such rights might be applied.
The patent laws already in existence in France do not exclude plants and animals but naturally, as M. Bussard points out, a patent is not a guarantee of merit. This difficulty would be removed if these could be placed on a " Register of plants produced by breeding " which admitted only those varieties which previous tests had shewn to be of agricultural value.
The laws existing in Germany are not entirely satisfactory and the following resolutions were passed by the International Plant Breeders' Association in 1931 :

(1) " The discoverer's rights, both material and intellectual, of breeders with regard to species of plants created by them, should be protected in the same way just as completely as the patent laws protecting inventions of all kinds.
(2) The examination of species for which claims are made for legal protection should apply exclusively to proof of their originality."

In America the law applies to sports, mutants and hybrids and gives the producer the exclusive right of a sexual propagation, excluding tubers used for food such as the potato and artichoke.
The possibilities of making use of the regulations already existing in France to the advantage of the plant breeder are discussed in the report by MM. Tourneur frères.

575. SCHIEMANN, E. 633:576.16
Entstehung der Kulturpflanzen. (**The origin of cultivated plants.**)
Handb. Vererbungswissenschaft 1932 : **3** : Lief 15 : ix + 377 pp.
A summary of this is on file at the Bureau.

576. BARANEK, J. 633–1.557:575
Die Bedeutung der individuell gezüchteten Population für die Ertragserhöhung. (**The importance of individually bred populations for increased yield.**)
Verlautb. deuts. Sektion mähr. Landeskulturrates 1931 : **32** : 132–34.
By growing a mixed population of several pure lines the lack of plasticity, which is a danger in growing pure lines in an uncertain climate is overcome without loss in yield.

577. ROEMER, T. 633–2.4–1.521.6:575.1
Immunitätszüchtung. (**Breeding for immunity**).
Pflanzenbau, Pflanzenschutz und Pflanzenzucht 1932 : **8** : 261–65.
Is it possible to combine resistance to disease with high yield and other valuable characters and in view of the frequent appearance of new physiological races is such effort profitable?

If the strain proves resistant to the races already known, then it has accomplished its aim as the effect may last for many years and with regard to the combination of economic characters with disease resistance the following results are significant.
" Peragis " spring wheat is entirely satisfactory except in its resistance to rust, when crossed with the French resistant variety " Normandie " there is a monohybrid segregation in F_2 and among the progeny are resistant types with the good qualities of " Peragis."
By crossing " Chinese 166 " x " Strubes Dickkopfweizen " the same result has been obtained for winter wheat.
Crosses between " Grüne Dame " and v. Rümkers " Sommer-Dickkopf " and " Roter Schlanstedter " have given strains resistant to the two biotypes of *Ustilago tritici* which are most important in Germany. The progeny of these two crosses behave differently, however, towards a race of *Ustilago* from Turkey, one cross being immune, the other susceptible. The high yield of " Roter Schlanstedter " is also retained.
By crossing " Walpersii," a resistant variety of barley with " Heils Franken," a variety susceptible to loose smut, resistance was found to be dominant and strains with yield and straw-stiffness as good as the best barley varieties were found among the progeny.
There exist now 34 physiologic races of *Colletotrichum Lindemuthianum* but recently Schreiber has succeeded in breeding a race of *Phaseolus* which is resistant to them all besides being a bean that satisfies the requirements of the market.

578. Drahorad, F. 633.1–1.524.4:575:551.563
Bedeutung und Wert der Landsorten für die alpine Getreidezüchtung. (**Importance and value of land races for alpine cereal breeding.**)
Pflanzenbau, Pflanzenschutz und Pflanzenzucht 1930/31, **7** : 44–47.
The land races are peculiarly fitted to withstand the rigorous growth conditions of the Austrian Alps by their early maturity, drought and cold resistance and many other characteristics, in which they differ from high bred foreign varieties. These properties are the result of years of natural selection.
The poor ears, weak straw, low yield and other shortcomings, however, are equally pronounced. In improving these characters by breeding it is essential, the author states, to preserve their mixed nature, which is responsible for the reliability in the matter of yield in years of very different weather conditions. He recommends separating out the different types which make up the population (each in some way adapted to the local conditions, since it has not been eliminated by natural selection), breeding each of these separately and finally mixing them together again. The necessity of retaining the land races and of doing any breeding work in the actual locality for which the crop is designed is emphasized.

579. Frankel, O. H. 633.1–1.557
Analytische Ertragsstudien an Getreide. (**Analytical yield studies in cereals.**)
Der Züchter 1932 : **4** : 98–109.
A review of recent developments in yield studies, mostly by Engledow and others at Cambridge.

580. Berg, S. O. 633.11 Äring
633.11 Ankar II
Två nya hostvetesorter. Weibulls Äringvete för Skåne och angränsande kustprovinser, Weibulls Ankarvete II för övre delarna av Götaland. Utlämnas i marknaden hösten 1932. (**Two new winter wheat varieties. Weibull's Äring wheat for Skåne and the neighbouring coastal provinces, Weibull's Ankar wheat II for the upper parts of Götaland. To be put on the market, autumn 1932.**)
Weibulls Årsbok 1932 : **27** : 10–17.
Both varieties were raised from a cross between Ankar and Saxo wheat. They are high-yielding, very winter hardy and with a high hectolitre weight.

581. *VAVILOV, N. I. 633.11(63)

[The wheats of Abyssinia and their position in the general system of the wheats. (Contribution to the knowledge of the 28 chromosome group of cultivated wheats.)]

Suppl. 51 Bull. Appl. Bot. Genet. and Plant-Breed. 1931 : 236 pp.

The expedition to Abyssinia in 1926 and 1927 has revealed such a multitude of forms and varieties that the Abyssinian wheats are thought to contain the solution of the whole problem of the origin of the hard wheats. Many of these varieties and forms are unknown in any other part of the world.

The characters have been worked out in great detail by a group of collaborators. The greatest diversity occurred at particular altitudes, between 2,400 and 2,800 m. In these areas many forms were found which were more or less intermediate between one species and another and even intermediate between the 28 and the 42 chromosome group, although they almost all had 28 chromosomes. This group of wheats is regarded as an extremely primitive group, in which the separation of species with clearly defined specific characters is not yet complete. The presence here of characters commonly associated with the *vulgare* group in 28 chromosome wheats is emphasized in this connection—e.g. awnless and short awned forms, comparative ease of threshing, susceptibility to disease, laxness of ear, glumes with ill-developed keel, lack of roughness of ear and awns, " inflated " glume type with bent tooth in the *turgidums*, dark coloured margin to the glumes, type of leaf pubescence.

In the *durums* certain *turgidum* characters are observed, such as the short, inflated grain, many characteristics of *T. persicum* and certain also of *T. dicoccum* are observed and the bread produced closely resembles rye bread.

In addition to these characters the Abyssinian 28 chromosome wheats differ from the corresponding Mediterranean representatives in their extreme early maturity, possession of 4–6 vascular bundles in the coleoptile, frequency of endemic purple grained forms and preponderance of forms developing anthocyanin in the seedling and mature plant. Both rough and smooth chaffed forms were found, although rough chaff was rare in the *turgidums* and in all the purple grained or lax eared forms. Four distinct types of pubescence are described. The characteristics usually regarded as typical for *T. durum*, *turgidum* and *polonicum* respectively are largely absent.

Large numbers of new varieties have been established, keys to the determination of which are given.

Within the Abyssinian 28 chromosome wheats are found all known degrees of density, the lax forms being most common ; almost all lengths of tooth of the empty glume ; 2 distinct types of pubescence, both occurring in *T. durum*, *turgidum* and *polonicum* as well as in *T. vulgare* ; both hairy and hairless auricles.

When the study of the variation is extended to the 28 chromosome wheats as a whole it is very clear that it is much wider than the variation in the 42 chromosome group. Apart from endemic characters such as purple grain, found only in *T. durum* and *turgidum*, the longest awns are found in Mediterranean *durums* whereas some of the Abyssinian ones are awnless ; similar extremes are observed in respect of size of grain, ear and glume, in density, in leaf pubescence and waxiness and in earliness and disease resistance. Purple seedlings, smooth awns and more than 2 coleoptile bundles occur only in the 28 chromosome wheats.

The extreme variation and richness in forms together with the number of dominant endemic characters and conglomeration of specific characters leads to the conclusion that Abyssinia is the centre of origin of the *durums* and *turgidums*.

This is one of two primary centres of origin of the cultivated wheats, the second being the Himalayan centre for the 42 chromosome group. A secondary centre is assumed in Transcaucasia, where *T. persicum*, *T. Timopheevi*, *T. dicoccum*, *T. dicoccoides* seem to have originated, possibly by hybridization between Mediterranean and Asiatic forms. These 3 basal groups were the material upon which natural selection worked, as they gradually dispersed in all directions into regions differing in ecological conditions, separating as a result into the clearly defined species, sub-species and varieties as we know them.

* A translation of this paper is on file at the Bureau.

The first stage, the origin of the genera *Eutriticum*, *Aegilops* and possibly *Secale*, which were to give rise to the basal species in the Abyssinian and Himalayan centres respectively, is much more obscure, but probably occurred in Eastern Mediterranean countries, where the wild material of these genera is mainly found to-day.
As a result of extensive study the authors can find grounds for the retention only of *T. durum*, *turgidum*, *polonicum*, *dicoccum* and *persicum* in the classification of the 28 chromosome wheats, which is discussed at some length.
The great value of this vast material is in the wealth of new genes it presents for future breeding work.

582. KRAVCHENKO, ĪU. 633.11:575(47)
(Improvement by breeding of Stavropol'ska winter wheat.)
Bull. Ctavropol' Agric. Expt. Sta., Dept. Plant-Breed. 1931 : 24 pp.
The botanical varieties found among the local wheat, which is renowned for its quality, are given.
On account of the very different climatic conditions in different parts of the region which the station serves, breeding is done at three distinct points representing different conditions and it is hoped to select forms suitable for each of these sets of conditions.
The forms produced by selection from the local wheat have distinguished themselves in recent tests in respect of yield, baking quality, resistance to drought and cold. Descriptions and illustrations are given of the best numbers, with indications of their origin and detailed accounts of their agricultural qualities, comparing them with standard sorts.

583. PESOLA, V. A. 633.11:575(47.1)
Vehnän jalostustyöstä ja sen tuloksista maatalouskoelaitoksen kasvinjalostusosastolla. **(Wheat breeding in the Agricultural Experiment Station of Finland, Department of Plant Breeding, and the results.)**
Valtion Maatalouskoetoiminnan Julkaisuja 1932 : No. **43** : 118 pp.
The pedigree selection of the land races was begun in 1918. These proved more cold resistant but weaker in the straw than the Svalof wheats, also less resistant to yellow rust. In 1920 and 1921 crosses between these 2 types were made. Later attempts were also made to introduce earliness and baking quality.
The results are given of four years' tests of a number of the new winter wheat varieties and selections, together with certain commercial varieties.
An account is given of the yield, winter-hardiness, earliness (a desirable character in Finland even for winter wheat), standing capacity (the land wheats lodge particularly badly), reaction to *Puccinia glumarum* and *P. triticina* (most varieties, except the land races, were rather resistant to the former, many were less resistant to the latter), germinating capacity and other grain characters.
One of the land wheats, Pohjola, was outstanding in winter-hardiness, in which it was equal to the best land races of rye, and in earliness.
The variety Sampo, produced by the Department of Plant Breeding, proved to be very winter-hardy, productive, with good standing capacity, relatively early, decidedly rust resistant, with a normal 1,000 grain and hectolitre weight and good baking quality.
Other of the Department's varieties are indicated as inferior only in certain characters to Sampo, including some of the recent hybrids.
Similar results are given for spring wheats and certain hybrids resulting from crosses between spring and winter wheats—in which crosses the spring type was found to be dominant. Crosses were also made between two relatively late varieties to produce positive transgression in respect of the length of the vegetative period without losing any of the other characters. Good results were obtained in this way from the combination Marquis x Brauner Hankkija, the resulting variety Sopu being earlier than the Hankkija parent and this combined with its high yield makes it a valuable variety. The varieties from this cross are also superior to the parents in standing capacity.

Some of the very early hybrids were also highly resistant to *Puccinia glumarum*. The variety Sopu was, however, rather susceptible ; on account of its superiority in other characters, however, it was retained and used in further hybridizations. The baking and other grain qualities of both this and the sister wheats are excellent. The latter are somewhat later but more rust resistant than Sopu.

584. WAHLEN, F. T. 633.11:575(49.4)
Bericht über die Tätigkeit der Eidgenossischen landwirtschaftlichen Versuchsanstalt Oerlikon für das Jahr 1930. (**Report on the activity of the Federal Agricultural Research Institute, Oerlikon, for 1930.**)
Landw. Jahrb. Schweiz. 1932 : **46** : 59–136.
Plant breeding work has been concentrated on the cereals and particularly wheat. The number of varieties, lines, plots and square metres are given (p. 128).
A number of inferior lines has been discarded and the remainder will be used in a comprehensive breeding programme.
Maize breeding by the inbreeding and crossing method has been started to produce an early maize with high set of corn, suitable for ensilage.

585. REYES, J. A. 633.11:575(89)
Primeros enzayos del valor industrial de los trigos de pedigree en la Escuela de práctica y campo experimental de agronomía de Salto. (**First tests of the industrial value of pedigree wheats at the practical School and experimental field at Salto.**)
Rev. Fac. Agron. Montevideo 1931 : No. **5** : 121–24.
An indication is given of the influence of such factors as soil and time of sowing on the quality of the product and the necessity of taking these into account and controlling them as far as possible in making selections.

586. KAJANUS, B. 633.11:575.1
Les résultats des recherches génétiques sur le blé. (**The results of genetical researches on wheat.**)
Ann. Serv. Bot. Tunisie 1930 : **7** : 1–23.
A full summary of Kajanus's paper in Bibl. Genet. 1927 : **3** : 142–244.

587. TINGEY, D. C. 633.11:575.11–181.13
Inheritance of dwarfing in wheat.
Proc. Utah Acad. Sci. 1931 : **8** : 59–60.
F_2 and backcross results demonstrated the presence of two factors, D for dwarfing and I an inhibitor. Some common wheat varieties have both of these factors, some neither, and others the inhibitor alone.

588. HOLLINGSHEAD, L. 633.11:575.12:576.356
The occurrence of unpaired chromosomes in hybrids between varieties of *Triticum vulgare*.
Cytologia 1932 : **3** : 119–41.
Univalents were observed in a number of varieties and varietal hybrids. In the varieties the lowest percentage of univalents was 2·9 in Red Fife and the highest in Marquillo with 9·7 per cent. Hybrids of Marquillo and Hope with Garnet had nearly 40 per cent of cells with univalents and all but three of the ten hybrids examined had a higher proportion than the varieties.

Many of the univalent, bivalent and polyvalent types observed are figured. It is seen that it is not always the same chromosome that is involved and polyvalent combinations are of rare occurrence. High frequency of bivalents was accompanied by, and perhaps resulted from, a low number of chiasmata. Both these phenomena may be the result of a delayed onset of prophase.

589. KATAYAMA, Y. 633.11:575.127

Über den Ansatz und die Keimungsfähigkeit der Körner in reziproken intra- und intergenerischen Bestäubungsversuchen im Weizen-*Aegilops*-Kreise und die Sterilität der F_1 Pflanzen. (**The set of grain and germination in reciprocal intra- and intergeneric pollination experiments in the wheat *Aegilops* system and the sterility of the F_1 plants.**)

Agric. and Hort. 1931 : **6** : 1909–24.

Crosses were made with *Triticum*, *Aegilops* and *Aegilotricum*. In the crosses between 14 chromosome wheats and 14 chromosome *Aegilops* the set was better when *Aegilops* was the seed parent and the germination was also better. In crosses of 7, 14 and 21 chromosome wheat with *Aegilotricum* (n=28), both the set and germination were best for the 21 and least good for the 7 chromosome wheat species.

590. KATTERMANN, G. 633.11:575.127:633.14:576.356.1

Genetische Beobachtungen und zytologische Untersuchungen an der Nachkommenschaft einer Gattungskreuzung. (**Genetical observations and cytological investigations on the progeny of a genus cross.**)

Z. indukt. Abstamm.–u. VererbLehre. 1932 : **60** : 152–206.

A very small number of plants was obtained from the cross of a speltoid with *Aegilops ovata* and these gave rise to later generations mostly by free pollination. The cross was repeated in 1928.

These F_1 plants were in many respects intermediate between the parents ; the ear broke up in the *Aegilops* manner at the base, the second and third spikelets in the emmer manner. These F_1 plants were in the greenhouse quite sterile, with their own pollen and pollen of the parents, rye and *Ae. ventricosa*. A few grains were obtained in the field, mostly with *vulgare* pollen. The F_2 plants arising from these different pollinators are described. The ears were all tough, in the plants resulting from *vulgare* pollen the ear at the base broke in the *Aegilops* manner, from *compactum* pollen even this break did not occur. The F_2 also shewed a high degree of sterility. The plants resembled wheat more than *Aegilops* but all bore clear traces of the *Aegilops* parent.

The original F_1 and F_2 plants, as described in the earlier records, are compared with the ones above described. This comparison shewed that the original F_1 plants were of a very different type, the *Aegilops* break at the base of the ear, amongst other things, being absent. Detailed descriptions of the F_3 of this material are then given. In one family, in addition to *vulgare* forms, *Spelta*, speltoid and *compactum* forms were present. The ratios in which these and other characters segregated are given. The close linkage of the *Spelta* factor with awning and brittleness was made evident ; the latter linkage was broken in backcrosses of the extracted *Spelta* forms with *vulgare*. Complicated segregations for density were observed, other characters gave clear segregations ; the hybrids were characterized by a large number of florets per spikelet. The grain quality of a number of lines was determined and figures are given for protein content. The grains of all the hybrids were of a bluish-green colour and the bread produced was of an undesirable kind, resembling rye bread.

The second family to be described in detail contained mostly *Spelta* forms, segregating for awns. Ears breaking in the *Spelta* and *dicoccum* way were present, also ears displaying both these characters and others tough as *vulgare*. The fertility of most of these lines was low.

These comparisons lead the author to conclude that *Ae. ovata* had not entered into the parentage of the earlier hybrids. On the ground of the bluish-green grain and other considerations it is concluded that the material in question originated by out-pollination of the speltoid parent with rye pollen.

591. KATTERMANN, G. 633.11:575.127:633.14:576.356.1

Genetische Beobachtungen und zytologische Untersuchungen an der Nachkommenschaft einer Gattungskreuzung. II. Zytologische Untersuchungen. **(Genetical observations and cytological investigations on the progeny of an intergeneric hybrid. II. Cytological investigations.)**
Z. indukt. Abstamm.- u. VererbLehre. 1932 : **60** : 395–466.

A continuation of the previous article in which the chromosome behaviour of the newly obtained hybrids in F_1 and F_2 and of the parents is described.

The speltoid used as parent in 16·7 per cent of cases shewed chromosomes which failed to pair. These chromosomes were clearly of different lengths and the same two chromosomes were evidently involved in each case. Polyvalent chromosome groups were occasionally observed.

The *Aegilops* parent had 14 and the supposed rye parent of the earlier hybrids 7 haploid chromosomes.

The F_1 plants of the later cross all had 35 chromosomes ; 2–3, occasionally up to 5 bivalents, were observed, the rest being univalents. Extra nuclei were often formed and the pollen displayed a high degree of sterility. Amongst other irregularities trivalent chains were observed. The embryo-sac mother cell seemed to present less irregularities. There was an appearance here as if all 35 univalents had divided longitudinally, giving diad cells with 35 chromosomes each, i.e. diploid diads.

In the plant arising apparently from backcrossing with wheat pollen 59 chromosomes were observed, 14 diploids, 1 apparent quadrivalent geminus and 27 univalents and the hybrids of the F_1 with *T. compactum* possessed 49, with up to 19 bivalents and several polyvalents. Two " spontaneous *Aegilotricums* " had 51 ($18_{II} + 15_I$) and 55 ($18_{II} + 19_I$) respectively.

All these facts lead the author to conclude that the plants examined have arisen by fertilization of an almost unreduced egg cell by hexaploid wheat pollen.

The F_3 and F_4 of the original crosses were next examined. Out of 51 plants 15 had 42 chromosomes, the remainder deviated from this number to a greater or lesser extent, with corresponding irregularities of behaviour ; 4 had less, 2 had 41 and 1 fragment, 12 had 43 or 44, the extra ones being fragments ; tri– and quadrivalent combinations also occurred.

Descriptions are given of the chromosome behaviour of plants with 40, 41 and with 41 + 1 fragment. The fragment in the latter case united with a normal to form a (sometimes irregular) bivalent or with 3 others to form a " partial " quadrivalent complex. Polyvalents were observed in all these cases even in the 42 chromosome plants, although in many plants the disturbances are not more marked than in the speltoid parent.

The behaviour is then described of the plants with 43 and 44, in which 1 or 2 fragments respectively were observed, usually attached to their normal homologues. Varying numbers of univalents were also frequently present, together with polyvalent combinations.

The behaviour of the various types at anaphase is described. The components of the polyvalent groups usually go to different poles but in certain cases they divide unevenly. The univalents move intact to the poles or divide, according to their position in the nucleus.

The second maturation division is described. An account is given of a peculiar phenomenon of degeneration and other abnormalities of the pollen grains which are observed in many of the anthers and the nuclear disturbances associated with these. The majority of the degenerating microspores contained small extra nuclei and frequently 5 or 6 pollen grains were formed from 1 pollen mother cell. Greater degrees of sterility were observed in plants displaying extreme irregularity of chromosome behaviour. No case of more than 1 grain per floret was observed.

The rapidity with which the hybrids assumed the wheat type, both as regards morphological characters and chromosome condition, especially the small number of univalents, make it almost impossible that they should have resulted from an *Aegilops* cross. The fact that disturbances are present even in the 42 chromosome plants, amongst other things, indicates that the speltoid nature of the parent is not the only cause of the chromosome irregularity and the assumption that rye was one of the parents is entirely supported by the cytological considerations.

592. KIHARA, H. 633.11:575.127.2:576.356.34
Weitere Untersuchungen über die pentaploiden *Triticum*-Bastarde. II. **(Further investigations on pentaploid wheat hybrids. II.)**
Jap. J. Bot. 1932 : **6** : 35–62.

After a brief resumé of the author's earlier work, an account is given of the study of the set of grain in the cross *Triticum polonicum* x *T. Spelta*. An examination of the embryo sacs shewed that they were almost all sound but 57·1 per cent of the sound embryo sacs remained unfertilized and failed to develop embryos, the remainder developed embryos but only about half of these developed into grain. The proportion of zygotes eliminated thus amounted to 24·4 per cent.
That the embryo sacs are sound has been shewn in a *T. Spelta* x *turgidum* hybrid by backcrossing with *T. Spelta* pollen, in which 90·37 per cent success was obtained. The failure of fertilization in the first cross must therefore be due to elimination of the pollen grains with the intermediate chromosome numbers and the author quotes cases in which the greatly reduced growth rate and power of fertilization of the 20 chromosome pollen grains compared with those with 21 is demonstrated. If, therefore, conditions are very favourable or pollen is shed on the stigmas very abundantly, or both, then it should be possible to get grains in every floret. The former condition seems to be of more particular importance.
A 34 chromosome plant (14II + 6I) of the cross of a 40 chromosome dwarf with *T. polonicum*, representing the extreme degree of sterility of the " fertile " chromosome combinations, was studied similarly. Here the very low set of grain was nearly entirely due to failure of fertilization, not more than 4·69 per cent of the zygotes being eliminated. It is shewn that pollen grains with 14 chromosomes are produced in this case extremely rarely and with 21 more seldom still.
Comparative observations of pentaploid hybrids in different localities also shewed that the set was in complete dependence upon external conditions, different pentaploid combinations reacting differently to particular localities.
In applications of mixed *durum* + *vulgare* pollen to *T. durum* and *T. vulgare*, there was a very marked preponderance of non-hybrid seeds when *T. vulgare* served as seed parent (248 *vulgare* plants to 26 hybrids) but with *durum* as female parent the numbers were equal, although the number of non-germinated seeds was greater.
A discussion of the results of other authors in conjunction with his own, leads the writer to the conclusion that a differential functioning in favour of the 14 chromosome egg cells occurs except when conditions are particularly favourable for seed development.
The lower germination power of grains with haploid genoms is confirmed by the results. The whole study of pentaploid hybrids indicates the necessity for complete genom sets in order to retain the power of normal development and reproduction.

593. KOSTOFF, D. 633.11.575.129:576.365.5
(*Triticum dicoccum* x *Triticum monococcum*) x *Triticum vulgare* **triple hybrid with 42 chromosomes.**
Cytologia 1932 : **3** : 186–87.

A hybrid containing complete genoms from the three different species is reported, having been obtained by pollinating *T. dicoccum* x *monococcum* hybrids, which formed unreduced gametes having 21 chromosomes, with *T. vulgare* pollen, also having 21 chromosomes. From such a cross two plants with 42 somatic chromosomes were produced and were found to combine characters of all three species.

594. LEWITSKY, G. 633.11:575.129:633.14
633.11:575.127:633.14
Zur Geschichte der fruchtbaren, intermediären, konstanten Weizen-Roggenbastarde. **(The history of the fertile, intermediate, constant wheat-rye hybrids.)**
Der Züchter 1932 : **4** : 76–78.

The author points out that he is not responsible, as Tschermak has stated, for the discovery of the constant hybrids in question, which were discovered at the Saratov station. A very brief account of the literature referring to these hybrids is given.

595. *Lewitsky, G. A. and Benetzkaia, G. K. 633.11:575.129:633.14:576.356.5
(**Cytology of the wheat-rye amphidiploids.**)
Bull. Appl. Bot. Genet. and Plant-Breed. 1931 : **27** (1) : 241–61.
Plants of later generations, but all originating from three of the constant hybrids discovered in F_2, were cytologically examined and found to have 56 somatic chromosomes or exactly double the number of the F_1 hybrids.
Certain irregularities were observed during meiosis, the most characteristic being the presence of lagging and dividing univalents. As, however, the somatic chromosome number shewed no deviation a selective action is inferred.
A review of the available data suggests that such irregularities are not uncommon in amphidiploids and other hybrids of this type.
The lack of chromosome pairing when two diploid sets are present is thought to be due to conditions within the cell. The possible origin of these amphidiploids is then discussed.
The complete lack of any viable pollen in the F_1 rules out the possibility of the fusion of two gametes with the somatic chromosome number. No microspores with the unreduced number have yet been observed.
An examination of a few ovules shewed that the number of chromosomes in the stages following diakinesis was 28 or near to that number. Nikolaeva and Plotnikova investigated the cytology of the hybrids of such plants with *vulgare* wheat and found in them numbers from 42–49.
There is then an increase in chromosome number in the ovules but the results do not entirely explain the invariable possession of 56 by the amphidiploids.
Against the possibility of the apogamous development of a 28 chromosome F_1 egg cell which doubled its number at the first division must be set the absence of amphidiploids in F_1.
At present, therefore, there is no entirely satisfactory explanation of the origin of these constant hybrids.

596. Boerger, A. 633.11:575.148
Las lineas puras en la agricultura. (**Pure lines in agriculture.**)
Arch. Soc. Biol. Montevideo 1930 : (Supl.) **1** : 189–211.
The question of heterosis and inbreeding is discussed and the views of several authors quoted. An explanation is given of the concept of pure lines, followed by an account of the author's work in pure lining the extremely heterogeneous local wheats. The author emphasizes the fact that many of the best families came from mother plants comparatively unprepossessing. The selected varieties obtained in this way exceeded the original varieties in yield by over 100 per cent. The most outstanding of these, a wheat of extremely good baking quality, is described. Various other questions on certain dangers attached to the cultivation of one pure line in large areas are discussed.

597. Lefèvre, J. 633.11:575.183
Sur un cas d'hérédité unilatérale présenté par le blé. (**A case of unilateral inheritance in wheat.**)
C. R. Acad. Sci. Paris 1932 : **194** : 561–63.
A plant is described which appeared in a cross of two *T. vulgare* strains, K.3 de Schribaux and Rieti, which resembled entirely the Rieti paternal parent and remained so in succeeding generations.

598. Hacizade, M. 633.11:581.9(49.6)
Die Verteilung der Weizenarten in der Türkei. (**The distribution of wheat species in Turkey.**)
Der Züchter 1932 : **4** : 70–76.
The land races display the most extreme diversity of type, sometimes containing as many as 3–4 species and up to 20 varieties. A study of these has revealed a number of new forms of such species as *Triticum pyramidale*, *T. orientale* as well as of the more common species.

* **A full summary of this paper is on file at the Bureau.**

Nearly all varieties of these species were present, the eligulate forms being very nearly the only exception.
Extreme variations of climate are observed in the country and there are wheat varieties suited to them all. Material of the greatest value in respect to resistance to various unfavourable conditions of cultivation, as well as to diseases, is present therefore. Samples of the land races from all the most important localities were received at the central station ; the chief types were chosen out and subjected to a detailed examination, being grown at several different parts differing in climatic conditions. In this way it is hoped that it will be possible to discover the most generally resistant types and to retain these for further work.
The present article deals only with the geographical species and varieties. Many transitional forms and hybrid forms between one species and another were present and many of these have been isolated and are under investigation.
The author concludes that, on account of the extreme wealth of forms, Asia Minor must be regarded as the gene centre for : *T. pyramidale*, *T. orientale*, *T. durum*, *T. duro-compactum*, *T. persicum*, *T. vulgare* and *T. compactum*.
A list is given, with brief descriptions, of the new varieties discovered.

599. FRIEDBERG, R. 633.11-2.111-1.547.2
Contribution a l'étude du tallage du blé. Relation entre la profondeur du noeud de tallage et la résistance au froid. (**Contribution to the study of the tillering of wheat. The relation between the depth of the tillering node and the resistance to cold.**)
Ann. Agron. 1932 : **2** : (N.S.) 215–28.
Grains of varieties of wheat, classified according to their resistance to cold into resistant, fairly sensitive, very sensitive and spring varieties, were sown at depths varying from 1—8 cm. to determine the effect of deep sowing on the position of the tillering node and whether there was any correlation between the behaviour of the varieties under such conditions and their resistance to cold.
The results shew that in all varieties the length of the tillering node increased with the depth of sowing, the extent being a varietal characteristic that is independent of depth of sowing as is also the number of tillers from the coleoptile node. Those varieties forming their tillering node close to the grain, form, at the greater depths, a second node which becomes the principal tillering node.
There was a correlation between the position of the tillering node and resistance to cold but it was not absolute.

600. FLOR, H. H. 633.11–2.451.3:576.16:575.12
Heterothallism and hybridization in *Tilletia tritici* and *T. levis*.
J. Agric. Res. 1932 : **44** : 49–58.
New forms of these fungi have recently appeared.
By pairing 12 single primary sporidial cultures of form 3 of *T. tritici* its heterothallic nature was demonstrated. A number of sex groups were shewn to exist. The same was true for *T. levis*. Pairing also occurred between monosporidial lines of different forms and between two lines of different species. Lines of both species occurred in one and the same sex group.
Such hybridizations are thought to be a potent means of originating new physiological forms.

601. BRESSMAN, E. N. 633.11–2.451.3–1.521.6
Susceptibility and resistance of wheat varieties to bunt.
J. Amer. Soc. Agron. 1932 : **24** : 249–55.
The resistance to a collection of 10 physiologic forms of bunt was tested on nearly 200 varieties of wheat. No variety was completely resistant and some were 100 per cent susceptible. The more resistant varieties were Quality, Ridit, Minard, Beloglina, Ashkof, Bacska, Iobred, Acme, Akrona, Arnautka, Nodak and Velvet Don.

602. BRIGGS, F. N. 633.11–2.451.3–1.521.6:575
Inheritance of resistance to bunt, *Tilletia tritici*, in crosses of White Federation with Turkey wheats.
J. Agric. Res. 1932 : **44** : 121–26.

The object of these crosses was to make a closer study of the factors concerned with resistance to bunt. The resistant wheats Turkey C.I. 1558 and Turkey C.I. 3055 were crossed with the susceptible White Federation. The bunt inoculum used was derived from Physiologic Race III of *Tilletia tritici*.

The results of the F_2 based on an analysis of F_3 are in good agreement with a 1 : 2 : 1 ratio. The percentage of bunted plants differed slightly in the two crosses, the difference probably being due to modifying factors. The possibility that the factor here is the same as that in Hussar wheat is being tested in crosses with selection 1418.

Crosses were also made between the Turkey wheats and Martin, a variety with a single dominant factor. The F_2 contained 4·7 and 4·9 per cent of bunted plants, indicating that the resistant factor of the Turkey wheats is not the same as that of Martin.

603. GASSNER, G. 633.11–2.452:576.16
Das Standardsortiment zum Nachweis der physiologischen Spezialisierung des Weizenbraunrostes, *Puccinia triticina* Erikss. (**The standard assortment as proof of the physiological specialization of the yellow rust of wheat, *Puccinia triticina* Erikss.**)
Arb. Biol. Reich. Land.– u. Forstw. 1931 : **19** : 403–06.

The work already published, as well as a correspondence with Professor Johnstone, is reviewed with a view to the simplification of the assortment used by Mains and Jackson and as a result three types, Turkey 47, Norka C.I. 4377, and Unnamed C.I. 3747 are found to be identical in reaction with some of the other types used and are therefore discarded.

604. TSCHOLAKOW, J. W. 633.11–2.452 *P. triticina*:576.16
Ein Beitrag zur physiologischen Spezialisierung des Weizenbraunrostes, *Puccinia triticina* Erikss. (**A note on the physiological specialization of the yellow rust of wheat, *Puccinia triticina* Erikss.**)
Arb. Biol. Reich. Land.– u. Forstw. 1931 : **19** : 407–11.

Six different biotypes were isolated from 82 tested strains from 13 different places of origin, i.e., forms 11, 13, 14, 17, 20 and 25, a form not previously identified ; these were tested on the standard assortment and the identity in reaction of certain of the varieties agreed with the findings of Gassner.

A table is given comparing the occurrence of several forms of rust in different localities with the results of Scheibe.

605. PEKLO, J. 633.11–2.452–1.521.6:575.125
Obtention de blés résistants aux rouilles en Tchécoslovaquie. (**Production of rust resistant wheats in Czecho Slovakia.**)
Rev. Bot. Appl. Agric. Trop. 1932 : **12** : 285–91.

Hybridization work was begun in 1913 using *durum* (Kubanka) and Pansar wheats as resistant parents.

The genetic results confirmed those of Nilsson-Ehle that several factors were concerned in resistance.

No linkages were observed which prevented the union of resistance with other qualities such as yield, strong straw, grain quality.

Hybrids of Kubanka and Svalöf winter wheat have been further crossed with Czech " alternative " wheats and with Svalöf winter wheats with the object of augmenting both the resistance and grain quality of the hybrids. In order to get also higher yield and standing capacity the best of each series have been crossed together. The resulting hybrids have displayed surprising vigour of growth and rust resistance. This effect is ascribed to heterosis, which has been frequently observed in the crosses. The quality of the grain and the yield are outstanding.

606. JÁNOS, H. 633.11:664.641.016
A búza minöségi tulajdonságai variációs-statisztikai megvilágitásban. (**The characters determining the quality of wheat in the light of variation statistics.**)
Mezögazdasági Kutatások 1932 : **5** : 37–62.
The constancy and correlation with baking quality of various properties of grain and flour were determined.

607. NEWMAN, M. 633.11:664.641.016:575
The breeding of spring wheat in Canada with special reference to the inheritance of baking quality.
Bull. Assoc. Internat. Selectionneurs Plantes, 1931 : **4** : 269–79.
The variety Red Fife is well-known for its excellent baking quality, it is however too late-ripening to be cultivated with safety in large parts of Canada. It was therefore crossed with an early ripening wheat, but of poor baking quality, Ladoga, imported from Riga. The results were the varieties known as Preston and Percy as well as, using White Fife, a white kernelled strain, Huron, and Stanley. With regard to baking quality these four varieties lie between their parents.
Crosses between a Russian wheat, Onega, and an Indian wheat, Gehun, produced Early Riga, a variety with high baking quality from which Riga M was later selected. Riga M was crossed with Preston and produced Garnet, a wheat ripening 7–10 days earlier than Marquis and with a better baking quality than its parents. The quality of the gluten differs from that of Marquis and mixtures of the two are of special importance for blending. A sister variety, Pioneer, with even better baking quality has not been an agronomic success.
Ruby was derived from another selection of Early Riga, Downy Riga G x Red Fife D, a selection from Red Fife. In baking quality it ranks with Marquis and Red Fife but is poor in yield and shatters easily.
A variety, Alpha, was obtained from a cross between Ladoga and White Fife, was then crossed with an Indian wheat, Hard Red Calcutta. A variety from this cross, Fraser, was crossed with Gehun and produced Prelude. It is early and of good quality but poor in yield.
Marquis is the result of a cross between Red Fife and Hard Red Calcutta and represents one of the greatest successes in plant breeding. In quality it is as good as Red Fife and it ripens a week earlier, it has stronger straw and less tendency to shatter and is less susceptible to disease.
The cross Marquis x Prelude has produced Reward which ripens a week earlier than Marquis and is more resistant to stem rust. Not only has it a high baking quality but it is able to maintain it over a wide range of country. Although the precise nature of baking quality is not known its heredity is clearly demonstrated by these results.

608. GAUFFIN, G. 633.13
Redogörelse för vid lantbruksförsöksanstaltens avdelning för växtförädling utförda försök med olika havresorter åren 1928–31. (**Account of the experiments of the Department of Plant Breeding of the Agricultural Experimental Station with different varieties of oats 1928-31.**)
Tidskr. Finl. Svenska Lantm. 1932 : **14** : 79–82.
The grain and straw yield, grain quality, 1,000 grain weight, hectolitre weight, husk content, straw stiffness and earliness were determined in the following local varieties, Esa, Kyto, Osmo II, Pelso and the lines 0337 and 0396 bred by the department and the Swedish varieties Engelbrekt, Guldregn, Seger and Vit Odal.
Line 0337 shewed the highest yield and in all respects is a most suitable variety for cultivation in the black-oat districts and it is possible that it will be put on the market in a year or two.

609. ÅKERMAN, Å. 633.13 Sirius
Svalöfs Siriushavre (01210). Ny, mycket tidig svarthavresort. (**Svalöf's Sirius oats (01210), a new, very early black oat variety.**)
Sverig. Utsädesfören. Tidskr. 1932 : **42** : 161–67.
Sirius oats from the cross 01180 (from Seger x Kron) x Klock II has shewn itself to be on an average

8 days earlier than Argus. In grain yield it is only inconsiderably inferior to Argus and Engelbrekt II. In straw yield it has been both higher and lower than Argus and decidedly lower than Engelbrekt II. The straw is very stiff. It has about the same high hectolitre weight as Seger and the grain content is also high. The grains are large, unusually short and plump with, as a rule, a relatively long and weak awn. The panicles are lateral and in the early stages plumage-like. The base of the grain is either smooth or with solitary long hairs. The rachilla is smooth. The leaves are glabrous, only the nodes are pubescent.
Sirius is recommended for humus-rich, not too dry, well cultivated soils.

610. WEBER, C. A. 633.13:575.42
Die Züchtung des hellgelben und goldgelben nordwestdeutschen Moorhafers. (The breeding of the light brown and golden brown, north west German moor oats.)
Mitt. Ver. Moork. Berl. 1931 : **48** : 193–
Selection was begun in 1895 on a strain of oats grown for 300 years on the moors of north-west Germany and known as " black north west German moor oats."
The lighter coloured grains were first collected and grown, later those panicles with the most light coloured grains were selected and by 1903 constant strains of light brown and golden brown grained oats had been established.
In order to improve the straw stiffness a mixture of these and Svalöf's Ligowo oats was sown. In 1920 a form was found with a lateral panicle with more or less upright branches which proved constant and which retained the grains better than the normal form. A new élite plant with a narrow cylindrical, lateral panicle was found in 1926.
Short strawed strains were also selected and strains with increased resistance to rust.
Further selection is needed but the author considers that other and more rapid methods might be profitably employed.

611. REED, G. M. 633.13–2.451.2–1.521.6:575.1
Inheritance of resistance to loose and covered smut in a hybrid of Early Gothland and Victor oats.
Amer. J. Bot. 1932 ; **19** : 194–203.
One of the parental varieties, Early Gothland, is very susceptible to loose smut, *Ustilago Avenae* and very resistant to covered smut, *U. levis*, the other, Victor, is very susceptible to each kind of smut. All the F_2 plants tested with loose smut were susceptible.
One hundred and forty-seven F_2 plants were inoculated with covered smut and a 10 per cent infection was obtained indicating the dominance of resistance and segregation in F_2.
An F_3 was grown from uninoculated plants and from plants which had survived inoculation with covered smut. These F_3 plants were inoculated with loose smut and proved highly susceptible.
There was marked segregation among the F_3 plants from uninoculated F_2 plants inoculated with covered smut, into resistant, segregating or less than 50 per cent susceptible, and susceptible or more than 50 per cent susceptible. Of the 52 progenies grown, 18 were resistant, 27 segregating and 7 susceptible.
The F_3 progenies, from F_2 plants inoculated with covered smut, were tested with covered smut and of the 107 plants 43 were resistant and 63 segregating.
The resistance was continued in F_4. There was no relation between glume colour and resistance to smut.

612. REED, G. M. 633.13–2.451.2–1.521.6:575.1
Inheritance of resistance to loose and covered smut in hybrids of Hull-less with Early Gothland and Monarch oats.
Amer. J. Bot. 1932 : **19** : 273–301.
Early Gothland is highly susceptible to loose smut and resistant to covered smut, the variety Monarch shews exactly the reverse behaviour, Hull-less is very susceptible to both loose and covered smut.

Early Gothland x Hull-less. All the F_2 progeny of this cross were susceptible to loose smut and this result was confirmed in F_3. 46 per cent of the progeny was susceptible to covered smut. For the F_3 data, the progeny of F_2 plants resistant to covered smut and uninoculated plants were used. In the first case the results were 18 progenies classified as resistant, 56 as segregating and 18 as susceptible. In the second case 3 progenies were resistant, 17 segregating and 25 susceptible. Data were also obtained from F_4 from resistant plants inoculated in F_3 and from plants inoculated in F_2 and F_3. Of the 88 progenies grown only 3 shewed complete resistance.
Monarch x *Hull-less.* All the F_2 plants were susceptible to loose smut. 31·3 per cent of F_2 plants inoculated with covered smut were infected.
The results in F_3 from plants uninoculated in F_2 were as follows: 9 progenies resistant, 51 segregating and 30 susceptible and from inoculated F_2 plants 54 progenies were resistant, 181 segregating and 26 susceptible though 15 of these gave only 50–60 per cent infection and probably belong to the segregating group.
In F_4, from uninoculated F_2 plants of the 48 progenies grown, 24 contained one or more infected plants. From the 136 F_4 progenies of inoculated F_2 plants 62 contained one or more infected plants.
The results shew a surprising difference when compared with those from the cross Early Gothland x Victor (see preceding abstract). These results and those of other workers are discussed.

613. HAYES, H. K. 633.13–2.452–1.521.6:575
Minnesota produces two new varieties of oats resistant to stem rust.
Seed World 1932 : **31** : (8).
Two new varieties Anthony and Minrus are described.

614. RICHEY, F. D. 633.15:575
El cultivo y mejoramiento del maiz. **(Maize cultivation and breeding.)**
Bol. Agric. Colombia 1931 : **4** : 115–22.
A brief description of the methods of mass selection, ear to row selection, the single and double cross methods of using inbred lines and the combination of a number of inbred lines to form "synthetic varieties."

615. SOKOLOV, B. 633.15:575
(Materials for the breeding of corn.)
Lenin Acad. Agric. Sci. U.S.S.R.; Sci. Res. Inst. Corn and Sorghums Economy 1932 : **21** : 69 pp.
An outline is given of various selection methods in maize, with indications of a number of important considerations in making the selections, largely based on the American work. Russian publications are also reviewed and from these it is seen that the grains taken from the base of the cob gave plants with as high yields as those from the centre, only the grains from the tip having materially reduced the yield.
The majority of varieties of maize have been obtained by the method of mass selection described, especially those displaying resistance to diseases or unfavourable conditions of soil, climate etc., and this is the best way of maintaining the yield of these specially adapted varieties.
The method of ear-to-row (or individual) selection is next described on similar lines. The comparatively low degree of improvement resulting from the application of this method over a number of years is emphasized—the usefulness is limited to the first few years of improvement, mainly of types not yet acclimatized to a particular region. This is opposed to the outstanding results obtained by the methods of hybridization which are next described. Results obtained in the U.S.S.R. are described which are similar to those reported from America, enhanced yields and earliness being obtained. Results of Talanov are cited in which the yield increase resulting from certain combinations of 2 commercial varieties did not fall off to any appreciable extent in the second and later generations. The value of inbreeding in order to make use of hybrid vigour is illustrated also by reference to the American experiments. The successes in increasing yields and creating varieties resistant to diseases and unfavourable soil conditions are indicated.

616. KHADJINOV, M. I. 633.15:575(47)
(Modern methods and problems in maize breeding.)
Bull. Appl. Bot. Genet. and Plant–Breed. 1931 : **27** (2) : 383–476.
The object of the work is to apply modern American methods of maize breeding in the U.S.S.R. and to make use of the great wealth of material presented in the world collection of maize made by the Institute of Plant Industry.
A full review is given of the genetic and breeding work in the United States, with a detailed description of the methods.
The second part deals with maize breeding in the U.S.S.R. This consists of introducing selected varieties from the U.S.A. and " investigating the value of individual characters of a morphological and biological nature which can be observed in the aboriginal sorts of America and the Old World." The world collection of the Institute contains over 8,000 samples, representing every maize growing country in the world, from 55° latitude to the most torrid zones near the equator. This material revealed great variety in time of maturity, types with vegetative periods from 85 days to 10 months being found. Early forms were collected from a number of places in northern latitudes and at high altitudes. Certain Central Asiatic forms were characterized by a short period between flowering and ripening. Central American lines capable of withstanding reduced temperatures were also found, and lines from Central Asia resistant to drought. The forms from Persia, Central Asia and Western China displayed a peculiar type of flowering, the female inflorescence appearing 2–4 days before the male. These types also proved to be very resistant to drought during the period of flowering.
From Bolivia and Peru forms have been collected whose leaves remain green and fresh up to the time of ripening.
Forms with certain useful morphological features were observed also, such as long mesocotyl which enables the grain to germinate when sown very deep. The height of the plant (connected with the period of maturity) varied from 80 cm. to 7 m ; certain Central Asiatic forms have very much reduced internodes but are otherwise normal—they have strong root systems and are very resistant to lodging. This character is not inherited on simple lines but segregates out in the F_2 and F_3 of crosses with the normal.
Certain forms from Central Asia, Japan and Mexico display high tillering capacity ; certain South Mexican forms, some early maturing, have leaves so closely enfolding the ear and so rough that the corn earworm is unable to attack them. Certain Peruvian and Chilean specimens were found in which the central stem portion of the ear is extremely thin, as little as 3–4 mm. Forms are also present in which the cob develops high up the stem, a valuable character for machine harvesting.
An outline is given of the problems of maize breeding in the U.S.S.R. A group of early and medium early dent forms is most required. The use of local varieties in building up the desired strains is advocated.

617. JENKINS, M. T. 633.15:575.11.061.6
An additional pair of factors affecting anthocyanin pigment in maize.
J. Agric. Res. 1932 : **44** : 495–502.
A new factor pair A_2a_2 is complementary to A_1a_1, Cc and Rr in the production of aleurone colour and inherited independently of these three pairs of genes.

618. MCCLINTOCK, B. 633.15:575.116.4:576.312.36
Cytological observations of deficiencies involving known genes, translocations and an inversion in *Zea mays*.
Res. Bull. Missouri Agric. Expt. Sta. 1931 : **163** : 30 pp.
Pollen grains containing known dominant genes were X-rayed and applied to the corresponding recessives. The progeny contained one or two plants lacking the dominant genes and these plants were examined cytologically. Similarly young embryos heterozygous for known genes were X-rayed and produced plants lacking the dominant in question. These were examined cytologically.

Two plants deficient for the Lg gene were produced in this way. The gene is placed at the end of the chromosome map and these plants shewed a deficiency at the end of the short arm of the B–1g chromosome. The deficient area in one of the plants was longer than in the other and in this plant 50 per cent of the pollen grains were empty. In the other, although 50 per cent were sterile they were partly filled with starch.
The end position of the gene A for anthocyanin formation was confirmed, numerous other genes were definitely located in certain portions of given chromosomes in a similar way and the order of the genes in the Y–P1 linkage group was determined.
Further deletions, translocations and other irregularities are described and figured, two alterations sometimes occurring at distinct points of the same chromosome. Deficiencies and ring chromosomes are thought to arise from a similar process to that giving translocations ; crossing over sometimes leads to a chromatid without an insertion region, which fails to travel to the poles and is lost.

619. HADDAD, E. S. 633.15:575.125:581.48
Morphological development of sweet corn pericarp in two inbred lines and their F_1 hybrid.
Bull. Indiana Agric. Expt. Sta. 1931 : **347** : 24 pp.
As " tenderness " is an important factor in the suitability of sweet corn for canning or use in the fresh state, a morphological study of two inbred strains differing in toughness of pericarp, and their F_1 hybrid, was undertaken in order to throw light upon the causes of toughness. Sections of the developing grain cut from samples collected at 5-day intervals from the 1-day stage up to the 35-day stage, shewed that the pericarp was thicker in the hybrid than in its parents until the 10-day stage after which it was thinner. Of the two integuments present the inner was thicker than the outer in all three, but in the hybrid the outer integument was thinner than in the two parents.
The process of resorption of the integuments, nucellus and ovular tissue was followed in detail and it appeared that the hybrid attained maturity earlier.
" Puncture tests " at the 20-day stage revealed that greatest resistance was offered by the hybrid ; the male parent shewed slightly less and the seed parent considerably less resistance. This being in inverse relation to the thickness of ovary wall at this stage, it was concluded that the thinner the ovary wall becomes after it has once attained its maximum thickness, the tougher it will be.

620. HULL, F. H. and GROSSMAN, E. F. 633.15:575.243.061.633
Heat-induced chlorophyll mutations in maize.
J. Hered. 1932 : **23** : 123–27.
Experiments are described which shewed that chlorophyll deficient stripes were produced in maize plants by high temperatures applied to the seeds.
Similar treatment did not produce chlorophyll deficiency in groundnut or barley but the effect was produced in both diploid and tetraploid species of teosinte.
So far no positive evidence has been obtained that these deficiencies are inherited.

621. BEADLE, G. W. 633.15:576.356.1:575.11
A gene in *Zea mays* for failure of cytokinesis during meiosis.
Cytologia 1932 : **3** : 142–55.
Plants are described in which failure of cytokinesis leads to the formation of 4n and 2n cells in place of n cells at microspore formation, together with various chromosome aberrations ; such cells are twice as large as normal microspore cells and quickly degenerate, leading to large proportions of sterile pollen. Such " variable sterile " plants and their progeny were all diploid and none of the 40 chromosome pollen cells apparently functioned.
In crosses with normals the " variable sterile " character behaves as a simple recessive and evidence is adduced to shew that it is linked with the genes gl_1 and v_8, in the order $va–gl_1–v_8$, with 11 per cent crossing over between va and gl_1.

622. RANDOLPH, L. F. 633.15:576.356.5:581.036.1
Some effects of high temperature on polyploidy and other variations in maize.
Proc. Nat. Acad. Sci. Wash., 1932 : **18** : 222–29.
The induction of polyploidy would frequently remove difficulties of incompatibility in species crosses due to differences in chromosome number.
Cytological examinations of maize root tips immersed for varying lengths of time in hot water at 40–45°C. shewed that the treatment resulted in a temporary cessation in growth. The tissue formed on the resumption of growth contained a much higher number of 4n sectors than the controls.
By applying similar temperatures to the ear-shoot at the time when the zygote was undergoing division in self and cross-pollinated plants of known genetic composition, plants were obtained in which the doubling of the entire chromosome set had occurred, or with deficiencies and translocations, failure of syngamy, atypical syngamy or parthenogenesis, in addition to various monstrous types. Some plants proved to be chimaeras of 2n and 4n tissue.
Most of the plants with chromosome deficiencies or translocations displayed a certain degree of sterility.
Diploid plants arising entirely from maternal gametes occurred, also paternal diploids ; none of these types has previously been observed in maize. A maternal haploid also occurred.
Attempts to induce such chromosome doubling by means of X-rays have so far failed, whilst gene mutations such as are produced by X-ray treatment have not been observed in these temperature experiments.

623. SPRAGUE, G. F. 633.15:581.162.4
The nature and extent of hetero-fertilization in maize.
Genetics 1932 : **17** : 358–368.
Hetero-fertilization is the name given to the process responsible for the production of the rare cases known where embryo and endosperm differ genetically.
Kernels with white aleurone are normally without red or purple scutellum colour but a few were found with colourless aleurone and coloured scutellum. These were used in experiments the results of which indicate that hetero-fertilization is not due to the persistence and functioning of the megaspore tetrad in the embryo sac or to mutation in an aleurone factor or factors ; non-disjunction at the equational division of the generative nucleus in pollen development is perhaps occasionally responsible for hetero-fertilized kernels but the principal cause of their occurrence lies in the functioning of two unlike sperms from two pollen grains, one fertilizing the egg-cell, and the other, the two polar nuclei.
The author believes that hetero-fertilization is quite widespread but its extensive occurrence is not generally realized because of difficulties in the way of its detection.

624. THOMAS, H. L. 633.15.061.5:575.116.1
The glossy character (gl_3) in maize and its linkage relations.
J. Agric. Res. 1932 : **44** : 167–73.
The glossy character is given by a quality of the leaf cuticle. Practically no difference in yield was found between normal and glossy plants.
The results of a study of the linkage relation shewed that the position of gl_3 was su–gl_3–Tu.

625. HANSEN, J. 633.16
Forsøg. med Sorter af toradet Byg. 1927–1930. **(Trials with varieties of two-rowed barley 1927-1930.)**
Tidsskr. Planteavl 1932 : **38** : 209–49.
The following 11 varieties were grown and tested at the different research stations for yield of grain and straw, straw-stiffness, earliness, hectolitre weight and chemical composition of the grain : Abed No. 32, Abed Kenia, Abed Opal, Abed Binder, Svalöf Sejr (Seger), Svalöf Guld, Abed No. 8, Abed Archer, Abed No. 11, Irish Archer and Tystofte Prentice.
The yield results for some other new varieties are also given.

626. HERTZMAN, N. 633.16 Kenia
Original Keniakorn. En ny, högavkastande och utomordentligt stråstyv sort. (**Original Kenia barley. A new, high-yielding and extraordinarily stiff-strawed variety.**)
Weibulls Årsbok 1932 : **27** : 7–10.
Kenia originated from a cross between Binder and Gull barley and is a sister variety to Opal. It is as early and has as good a quality as Binder and Opal but appreciably surpasses them in yield and is able to make good use of heavy nitrogenous manuring. It is so superior in straw stiffness to the older varieties that it stands in this respect in a class by itself.

633.16:575.11
627. ROBERTSON, D. W., DEMING, G. W. and KOONCE, D. 633.16:575.116.1
Inheritance in barley.
J. Agric. Res. 1932 : **44** : 445–66.
The inheritance of the characters for green and chlorina (Ff), green and virescent (Yy) seedlings and blue and white aleurone (Bl bl) was monofactorial. Rough and smooth awns were due to two factors (RR'rr') and the branching of the style to three cumulative factors (Gg, G'g' and G''g''). The inter-relationships of these and other factors were then studied.
The factor pairs F_cf_c for green and chlorina and Y_cy_c for green and virescent seedlings were linked with a crossover percentage of 29·30.
Linkage, with a crossover percentage of 18·3, was found between Ff and Vv the factors for 2 and 6 rowed.
Blbl and Kk for hoods and awns were linked with a crossover percentage of 20·58.
There was linkage between Rr and Ss for long and short-haired rachilla, with a crossover percentage of 34·63.
A possible linkage was indicated between Rr and one of the factor pairs for a branched style.
The following pairs of factors were tested and found to be inherited independently : Ff and A_ca_c and A_ta_t for green and white seedlings, Ff and F_cf_c, X_cx_c green and yellow seedlings and Yy, Ff and Ss, Ff and Kk, Blbl and X_cx_c, Blbl and Ss, Bb black and white glumes and Rr'Rr' and Bb and GgG'g'G''g''.

628. JAKOWSKI, Z. 633.16:575.127.2
Przyczynek do zna jomości jęczmion. (Rzadka krzyzówka). (**Contribution to the knowledge of barley—a rare hybrid.**)
Rocz. Nauk. Rol. 1932 : **27** : 289–96.
In the course of breeding work a hybrid has been made between *Hordeum tetrastichum* v. *Horsfordianum* Wittm. and *H. distichum* v. *nutans*.
A number of interesting forms, partly intermediate, were observed in F_2, for which the numerical relations and eight illustrations are given.
Among other things, forms with numerous florets per spikelet have been observed.

629. AUFHAMMER, G. 633.16:581.46:575
Ein Beitrag zur Kenntnis der Basalborste bei *Hordeum polystichum*. (**A contribution to the knowledge of the basal bristle in *Hordeum polystichum*.**)
Pflanzenbau, Pflanzenschutz und Pflanzenzucht 1931 : **8** : 231–37.
The long, unicellular hair type is distinguished from the short, multicellular hair type ; the former is designated the A, the latter the C type.
A variety is described in which the type of bristle is exceedingly variable and quite abnormal. The type seemed genetically conditioned, being handed on to the offspring.

630. ORLOV, A. A. 633.16:581.9

[The most important agronomical and botanical forms of barley (*Hordeum sativum* Jessen), studied on the back-ground of the collection of barleys in the possession of the Institute of Plant Industry and the principal varieties of spring barley in U.S.S.R.]

Bull. Appl. Bot. Genet. and Plant–Breed. 1931 : **27** (2) : 329–81.

The collection contains samples from every barley growing country in the world and its investigation has led to the conclusion that *Hordeum sativum* has two centres of diversity, the first in Abyssinia and Eritrea, the second in China and Japan.

Various points in which the Abyssinian barleys are characteristic and distinct from those of the rest of the world are indicated ; even the barleys of Egypt " have nothing in common with those of the given countries."

Comparative studies have shewn that the barleys of Europe, the U.S.S.R. and Northern Africa have come from the East, Asia Minor having had the most marked influence.

Indications are given of the types cultivated in the various parts of Europe and the parts of the world from which they have probably come. Asia Minor, Palestine, Syria, Pamir, Afghanistan and Persia have been the only sources and a further study of the barleys of these places has proved very profitable.

Although barley is cultivated almost universally, a distinct localization of hereditary characters was observed, thus in the Mediterranean region (Morocco, etc.) the large-grained forms are found, in Japan and China very small-grained forms, in the dry zones round Northern India very early forms, in the coastal districts of Western Europe and the Far East very late forms. Other characters also shewed this clear localization.

The characteristics of the barleys of the different areas are described. Abyssinia displays an astonishing wealth of forms concentrated in a very small area, apparently actually in the process of evolution. Here many characters are expressed in an extreme degree—e.g., large grain, high tillering, elasticity of straw, adaptability to extreme conditions either of moisture or drought, the former give grain with high protein, the latter grain with low protein and high starch.

Amongst the many forms of interest appearing in others of the countries treated, are forms resistant to drought, fungus diseases and frit fly, short-awned and awnless forms, very early forms and forms suitable for production of malting barleys and for production of valuable naked barleys by hybridization.

On emanating from the centres of diversity a gradual fall in the number of forms is observed. Each area has a particular predominating form, sometimes occupying as much as 90 per cent of the whole ; this is the result of natural selection on the part of the ecological conditions of each neighbourhood and the predominating form represents the form best adapted to the conditions of the particular neighbourhood. Out of the 120 varieties found in all, only 10 have been the predominating variety in some region or another and only three—var. *pallidum*, *nutans* and *medicum*—over any extensive area. All the pure-bred varieties belong to these three varieties. The enormous mass of remaining varieties, untouched by the breeder, constitutes an extraordinarily valuable material for future breeding.

For this purpose an élite stock was chosen consisting of the barleys from these varieties which shewed the most desirable agricultural features in the most pronounced degree, choosing where possible a number of lines, from different localities, for each character. A list of the characters for which representative lines have been chosen is given and the individual lines are then described. The characters in question are different times of maturity, resistance to drought, various fungous diseases and pests, straw stiffness and length, grain and ear and awn characters (including awnless and smooth-awned) and yield.

Systematically the species is divided into three sub-species, *vulgare* (six rowed), *distichum* and *intermedium*. The further subdivisions of these are given, forming three parallel (homologous) series. A key to the botanical forms is given.

Many valuable races of spring barley for fodder and malting purposes for the U.S.S.R. have been selected and a list of these is given, with brief indications of their origin and characters.

631. BARBACKI, S. 633.16–1.557:575.11
Z badań nad jęczmieniem. Cz. II. Zmienność i dziedziczenie niektórych cech fizjologicznych. Selekcyjna ważność cech. (**Studies on Barley. Variability and inheritance of some physiological characters. The importance of breeding characters.**)
Mem. Inst. Polon. Ec. Rur. 1930 : **11** : 579–610.
Pure lines of two and six rowed barley and their hybrids were used for this investigation.
Yield and tillering were characters shewing the greatest variation.
Several cumulative factors were concerned with yield. All the characters of the plant combined to cause marked transgression in yield in F_2 and F_3 but chiefly percentage content of grain. At least two or three cumulative factors determine the 1,000 grain weight. Earliness is due to one main factor with modifying factors.
There was linkage between ear-type and 1,000 grain weight and a weaker linkage between ear-type and time of heading.
The less variable characters and those most closely correlated with yield and quality—such as length and density of spike—are most important for selection.
The standard method was used in the investigation and is recommended.

632. SIEGLINGER, J. B. 633.174:575–181.13
Inheritance of height in broomcorn.
J. Agric. Res. 1932 : **44** : 13–20.
Crosses were made between a standard (tall) variety and two varieties of dwarfs. The cross standard x dwarf segregated in a 3 : 1 ratio.
The F_1 of the cross whisk dwarf x western dwarf was almost as tall as the standard variety and F_2 segregated in a 9 : 3 : 3 : 1 ratio.
The results indicate that the dwarf varieties differ from the standard variety, each by a single, different factor. These factors are combined in the F_1 of the cross between two dwarf varieties and the double recessive or double dwarf occurs in F_2. It is pointed out that such a recombination may be confused with hybrid vigour.

633. LONGLEY, A. E. 633.174:576.312.35
Chromosomes in grass sorghums.
J. Agric. Res. 1932 : **44** : 317–21.
The haploid chromosome number of the perennial *Sorghum halepensis* is 20. The annual species *S. sudanensis*, *S. verticilliflorum*, *S. virgatum*, *S. drummondii*, *S. hewisonii*, *S. arundinaceum* and many varieties of *S. vulgare* had 10 as the haploid number. Two exceptions to this rule were found, *S. versicolor* had 5 haploid chromosomes and *S. purpureo-sericeum* although an annual had 20.
There are also a few exceptions among the other genera of *Andropogoneae* ; the available data, applicable to the subject, are discussed.

634. SIEGLINGER, J. B. 633.177:575.42
Seed selection in Sunrise kafir.
J. Amer. Soc. Agron. 1932 : **24** : 411–16.
Comparison over a 5—12 year period of crops from (1) selected heads (2) selfed heads, (3) bulk seed from unselected plots and (4) bulk seed from increase fields shewed slight increase in grain yield per acre in favour of the larger number of heads produced by plants from selected heads. There was hardly any difference in weight of grain per head though plant height and straw yield per acre were slightly lower for the selected heads in the second half of the experimental period. As a whole the experiments seem to indicate that no progressive increase in yield is achieved by selection and there is no continued decrease upon selfing ; selection may, however, be worth while for maintaining purity and uniformity.

635. NAKAYAMA, K. 633.18:575.1–181:581.48
The segregation in the size of grains in crosses between normal and dwarf races of rice.
Jap. J. Genet. 1932 : **7** : 161–71.
The F_2 of a cross between a purple dwarf and an ordinary sort was studied. Considering the length of the grain, there was a clear segregation into normal and dwarf, normal being completely dominant. In respect of breadth there was no difference, beyond that due to fluctuation. Thus the normal ratio of length to breadth is dominant to the dwarf type.
The dwarf parent had glutinous grain but there was no apparent relation between these two characters in segregation, or between anthocyanin and grain size.

636. NAKAYAMA, K. 633.18:575.11.061.6
On the inheritance of anthocyanin formation in rice with special reference to the colour of stigma.
Jap. J. Genet. 1932 : **7** : 153–60.
A study was made of the F_3 generation of a cross between a green and a purple form. The colour in the leaf blade, sheath, ligule and auricle behaved as a unit, colour being either present or absent in all. Similarly for colour in the paleae, awn, stigma and glume. Segregation into 3 coloured : 1 green occurred for the first group of organs, the organs in the second group were all coloured ; the results are tabulated.
In other crosses 9 : 3 : 4 and 9 : 7 ratios were observed and the author concludes that there are 2 dominant factors both of which are necessary to form anthocyanin. When these are present colour is formed in the glume group but a third factor is necessary to form colour in the leaf group. The results conform to this hypothesis.

637. MORINAGA, T. 633.18:575.11.061.633
The chlorophyll deficiencies in rice.
Bot. Mag. Tokyo 1932 : **46** : 202–07.
Four chlorina varieties were crossed with normals and all gave monofactorial relationships. Some variegated forms behaved similarly, others, the so-called non-Mendelian types, invariably segregated large numbers of albinos when selfed and some of these when crossed with normals gave striped F_1's and irregular numbers of albinos and striped plants in F_2.
In other segregating F_3 and F_4 lines albino seedlings proved to be a simple recessive, whilst yellow seedlings appeared in certain progenies in both 1 : 3 and 1 : 15 ratios.

638. MORINAGA, T. and FUKUSHIMA, E. 633.18:576.356.5
Preliminary report on the haploid plant in rice, *Oryza sativa*.
Proc. Imp. Acad. Japan. 1931 : **7** : 383–84.
All rice plants previously examined have had 12 haploid chromosomes. Out of 13 plants from pollination of a normal variety with a dwarf variety 12 were normal hybrids but the 13th was small, in this like the paternal parent, but in other characters resembling the maternal parent. The plant produced only one seed and the pollen grains were very abnormal.
Root tip examination proved the plant to be a haploid with 12 somatic chromosomes.

639. NAKAMURA, S. 633.18:581.162
Cytological observations in two forms of sterile rice plant.
Proc. Crop Sci. Soc. Japan 1931 : **3** : 259–62.
A plant shewing a sterility of about 70 per cent is described. There were no chromosome irregularities or pollen degeneration and the pollen was perfectly viable. They displayed about 4 per cent parthenocarpy. The progeny were all sterile like the parent.
Another plant produced about 58 per cent of blasted ears and gave progenies of 1 normal : 1 semi-sterile which continued to segregate in a similar way. In these plants half the pollen degenerated. The embryo sacs also were 50 per cent abnormal.

640. MIYAZAWA, B. 633.18:581.162.51
On the two cases of semi-sterility in *Oryza sativa*.
Bull. Miyazaki Coll. Agric. and For. 1932 : No. **4** : 193–97.
Sterility may result from the complete degeneration of both male and female organs, or of one or the other, degeneration of the pollen grains resulting in "semi-sterility." This may also occur in other cases when the male and female organs are outwardly normal.
Abnormal forms are described in which the chief characteristic is the failure of the paleae to close, on account of the development of outgrowths probably from the lodicules in the one case and to the small size of the inner paleae in the other case.

641. SENGBUSCH, R. and LOSCHAKOWA, N. 633.367:575.42:581.48
Die Züchtung "weichschaliger" Lupinen (*Lupinus luteus*). **[Breeding "tender skinned" lupins (*Lupinus luteus*).]**
Der Züchter 1932 : **4** : 113–17.
The hardness of the skin is one of the numerous defects the removal of which breeding experiments are now in progress.
The seeds of about 20,000 plants were tested with regard to their swelling in water. Those which shewed signs of swelling after 3 hours were retained. In later experiments the percentages of swollen seeds after 2½, 5½, 8½ and 25½ hours were recorded and the results are here tabulated. The best lines gave 70—80 per cent swelling after 2½ hours and 80—100 per cent after 5½ hours, controls of normal skin type 0·9 per cent after 2½ hours, 20·7 per cent after 25½ hours and only 51·6 per cent after 9 days.
Studies of the genetics of the character are in progress. It is hoped that tender skinned lines, which obviate the necessity for special measures against delayed germination, etc., of the alkaloid-free type will be produced. It is also suggested that it should be possible to find tender forms of other plants, especially for wild leguminous plants which might be taken into cultivation.

642. MAGRUDER, R. 633.41:581.162.3
The successful pollination period of garden beets, *Beta vulgaris*.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 332–35.
Pollination experiments of emasculated flowers at different times were successful only on the day the anthers dehisced or the following day. In certain cases a few seeds were produced by pollinating on the second day and possibly on the third.

643. MAGRUDER, R. 633.41:581.162.52
Self-sterility and fertility in garden beets as indicated by seed production under paper bags.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 328–31.
Branches of the inflorescence were enclosed in glassine bags in 1930 and the bags shaken at noon each day during the period of flowering.
A total of 81·6 per cent of the plants appeared to be completely self-sterile ; some of the remaining ones which set seed failed to germinate, making in all 87·2 per cent which gave no progeny.
Partial fertility was exhibited by the remaining 12·8 per cent, in 3 of the plants to a quite high degree, producing progeny in sufficient quantity to satisfy the requirements of plant breeders.

644. RASMUSSON, J. 633.416:575.42
Studies on the breeding of cross-fertilizing plants. I. Effect of mass selection in mangels.
Hereditas 1932 : **16** : 249–56.
To test the soundness of the view current among Scandinavian breeders that mass selection within good strains of mangels, turnips and Swede turnips does not lead to any appreciable increase in yield of dry matter, experiments were made with two strains of mangels, viz. (a) a

" genically heterogeneous " white-skinned strain shewing unusually great variation in root length, (b) a reddish-yellow strain which was fairly homogeneous having been grown for at least eight generations under conditions that precluded out-pollination with other strains.
With the first strain samples of unusually long and unusually short roots were selected in 1927 and the progeny tested in 1931. The results disclosed statistically significant differences between the two groups in root length, average weight of root and percentage dry matter. There appeared to be positive correlation between root length and average weight of root and negative correlation between these two characters and percentage dry matter. Hence selection for long roots increased root weight but decreased percentage dry matter with the net result that dry matter yield appeared to be stable. There also appeared to be a correlation between long roots and bolting.
With the second strain selection was exercised for the following pairs of characters : high and low root weight, high and low percentage dry matter, high and low dry matter yield and gross weight, high percentage dry matter and yield. Average root weight appeared to be positively correlated with average dry matter per root and negatively with average percentage dry matter. The most effective selection was that for percentage dry matter but in all cases where the original roots were selected for a single character, the progeny tended to deviate in the direction of the selection, though in most cases the results were statistically not significant. The complex selection for high root weight, high dry matter percentage and dry matter yield had a significant effect on dry matter percentage, an insignificant positive effect on dry matter yield but caused an insignificant decrease in root weight.
To sum up, there appeared to be sufficient genic differences within the two strains tested to make mass selection effective in changing the progeny in one direction or the other but certain characters such as dry matter yield were relatively stable, probably because correlation with certain other characters caused a counter-selection of an undesired nature, which neutralized the effect of the attempted selection.

645. Terasawa, Y. 633.42:575.127:635.15:575.129
Tetraploid hybrids of *Brassica chinensis* L. x *Raphanus sativus* L.
Jap. J. Genet. 1932 : **7** : 183–93.
Tetraploid hybrids have been obtained by crossing *Brassica chinensis* (female) and *Raphanus sativus* (male) and are called therefore *Brassico-raphanus* hybrids to distinguish them from Karpechenko's *Raphanobrassica*. The hybrids had 38 diploid chromosomes, the *Brassica* parent having 20 and the *Raphanus* 18.
Six F_1 plants were obtained intermediate between the parents. No seed was set under bags but a certain amount set under conditions of free pollination. The F_2 individuals were also mostly intermediate. The tetraploid individuals came from the free-pollinated plants, occurring first in the F_4, 3 tetraploid individuals being found amongst 58.
The tetraploids were intermediate in type, perfectly fertile, bred perfectly true and formed perfectly normal gemini, the reduction division being almost entirely normal. The chromosome number 38 was confirmed in 12 individuals.
Under conditions of free-pollination only 4 hybrid plants were observed, thus only very little out-pollination occurs.
Only the lower third of the pods opens at maturity, the remaining two thirds remain closed.

646. Bonde, R. 633.491–2.411.4–1.521.6
A promising blight resistant potato.
Amer. Potato J. 1932 : **9** : 49–54.
A variety of the name of Foster's Rust Proof, resistant to *Phytophthora infestans*, is described. The variety is thought to have originated from composite crosses involving Irish Cobbler, Green Mountain, Carman and Beauty of Hebron.
The variety also proved to be less susceptible to rotting in the field and is not inferior to Green Mountain in yield and cooking quality. It has smooth white tubers and a firm tough skin and is regarded as a very suitable starting point for breeding for resistance.

647. SCHLUMBERGER, O. 633.491–2.412.5–1.521.6
Die neuen krebsfesten Kartoffelsorten. **(The new wart resistant potato varieties.)**
Deuts. landw. Pr. 1930 : **57** : 157–58.
The merits of a number of varieties which are now undergoing tests are discussed. Those of most interest are the yellow fleshed varieties to replace the susceptible Industrie. Of these Blaupunkt is one of the most promising. In this respect the 2 recent varieties Ackersegen and Erdgold are of particular interest, in that they are also resistant to scab, superior in yield to Industrie and equal to it in culinary quality.

648. JØRSTAD, I. and LUNDEN, A. P. 633.491–2.412.5–1.521.6:575
Investigations on the inheritance of immunity to wart disease [*Synchytrium endobioticum* (Schilb.) Perc.] in the potato.
Meld. Norg. LandbrHøisk. 1932 : **12** : 286–304.
The experimental methods are described in some detail.
Selfing the susceptible variety Centifolia and crossing it with other susceptible varieties gave only susceptibles.
Selfed progenies of six immune varieties segregated into three immune : one susceptible. This applies also to the variety Flourball and the results of Salaman and Lesley are interpreted on this basis rather than as a two factor ratio. The immunity factors in all these six varieties—Jubel, Hindenburg, Pepo, Seydlitz, Tannenberg and Flourball are regarded as identical and named X. Most crosses of immune with susceptible varieties segregated in 1 : 1 ratios. The Golden Lass x Centifolia cross, however, gave ratios approximating to three immune : five susceptible and it is thought probable that the former parent is heterozygous for two complementary immunity factors, Y and Z, distinct from that in the six varieties above and for one of which Centifolia is also heterozygous. It is further supposed that Jubel contains one of these two factors in the heterozygous state in addition to X and that Sagerud contains the other, thus accounting for the 5 : 3 ratios in the F_1 of this cross.
The variety Edzell Blue is also supposed to carry Y in the homozygous condition in addition to Xx ; this accounts for the 7 : 1 ratios observed in the cross of this variety with Richters Jubel (Xx yy Zz). In the cross Kerrs Pink x Richters Jubel 26 immune : 1 susceptible were obtained, from which it is concluded that Kerrs Pink carries two immunity factors X and X′ in a heterozygous condition and is at the same time homozygous for Y.

649. 633.491–2.8–1.521.6(49.3)
Journées d'études pour l'amélioration de la culture de la pomme de terre (Bruxelles 1931). **[Conference on the improvement of potato cultivation (Brussels 1931).]**
Bull. Agric. et Hort., Belg., 1931 : (5) : 24–115.
The results of experiments shew that it is possible to keep potato stocks free from disease by rigorous selection. A programme is given for testing new varieties with respect to resistance to virus and other diseases, culinary value and commercial value.

650. HAASE, G. 633.5:575
Um Grundzüge der Züchtung von Flachs und Hanf. **(Basis of breeding flax and hemp.)**
Faserforschung 1931 : **9** : 129–32
A brief review of the papers presented at the Conference of flax and hemp breeders, 26th—30th June, 1928 in Leningrad.

651. EMME, E. K. 633.51:575:016
(Review of literature on the genetics of cotton.)
Bull. Appl. Bot. Genet. and Plant-Breed. 1931 : **26** (5) : 129–78.
A rather complete bibliographical survey of cotton genetics in all countries.

652. O'Kelly, J. F. and Hull, W. W. 633.51:575–18:677.21
Cotton inheritance studies : lint percentage.
Tech. Bull. Miss. Agric. Expt. Sta. 1930 : **18** : 15 pp.
Crosses were made between varieties of *G. hirsutum* and between these and a variety of *G. barbadense*, Sea Island, to determine the inheritance of lint percentage. Segregation, where it was clear enough, indicated that the inheritance was monofactorial with high lint percentage partially or entirely dominant.

653. Szymanek, J. and Roehrich, O. 633.51:575.12(66.2)
Examen technologique de la fibre de quelques cotonniers expérimentés au Soudan Français et de leurs hybrides. (**Technological examination of the fibre of certain cottons studied in the French Sudan and of their hybrids.**)
Coton et Cult. Cot. 1931 : **6** : 187–98.
The local cotton, characterized by extreme adaptation and resistance to the climatic conditions of the locality, has been crossed with more productive varieties.
Descriptions are given of the fibre characteristics of a number of varieties used as parents, followed by similar descriptions of various of the F_1 hybrids. Some of these were superior to the parents in respect of both the fibre qualities and resistance.
Fertile hybrids were obtained between *Gossypium hirsutum* and *G. herbaceum-indicum* and between *G. vitifolium* and *G. herbaceum-indicum*. Although attempts to cross Allen were unsuccessful, the authors are not without hope that they may succeed in the future.

654. Cook, O. F. 633.51:575.42
Cotton improvement through type selection, with special reference to the Acala variety.
Tech. Bull. U.S. Dept. Agric. 1932 : **302** : 62 pp.
The author emphasizes the fact that while, in animal breeding, the main concern is with the individual, in plants that concern is with bulk. Commercialism is unlikely to produce adequate supplies of good seed in the cotton industry ; it tends towards the introduction of too many varieties while what is required is the maintenance of existing superior varieties. He concludes that seed improvement is essentially a community undertaking. The adaptability of a variety, defined as the retention of productivity under a wide range of conditions, becomes, thus, as important a character as uniformity while selection should be a means of preventing deterioration rather than a means of improvement. Too frequently in the past selection has concentrated on novelty and since diversity rather than uniformity seems to be inherent in all natural species, such selection has proved a blind road.
Four systems of selection are recognized ; mass, individual, progeny and type ; a combination of the two latter is required for maintenance of uniformity with adaptability. Difficulty arises in the determination of type for selection and the system of score cards has not given proved results. Fortunately variations are normally ' symphanic ' (occur, that is, in conjunction), and off forms can be identified by more than one character. Too severe a selection with limitation of the number of progeny rows is likely to eliminate the adaptability which has been shown to be a desirable and possible accompaniment of uniformity and for full maintenance of type it is necessary to maintain groups of progenies in different regions covering the range of conditions for commercial growth.
Illustrations of the application of the methods of selection here advocated are given by somewhat detailed reference to Acala cotton, particularly in its reaction to response to varying environmental conditions and conditions of stress.

655. Baranov, P. 633.51:576.312
(Work of the cyto-anatomical laboratory of N.I.Kh.I. during the growing period of 1930.)
Bull. Sci. Res. Cott. Inst. Tashkent 1930 : **5** : 7–17.
One of the first studies was the full history of the cotton plant from germination to maturity. The first stage in this was the study of the chromosomal apparatus. Seven Old World species

were found all to have 26 diploid chromosomes ; these were *Gossypium Stocksii*, *G. arboreum*, *G. Nanking*, *G. obtusifolium*, *G. herbaceum*, *G. abissinicum* and *G. intermedium*, whilst 7 New World species had 52—*G. punctatum*, *G. hirsutum*, *G. Palmeri*, *G. peruvianum*, *G. mexicanum*, *G. purpurascens* and *G. barbadense*.

A detailed examination was made of the morphology of the chromosomes in the various species. Clear differences were evident, chromosomes with equal and unequal arms, divided and undivided arms and with or without satellites being observed, as well as differences in size of the respective arms and of the satellites. The karyotype for each species and its component varieties is now under investigation.

The microsporogenesis was studied in representatives of the 26 and 52 chromosome groups, the size of bud in which it was taking place was determined ; for this the stages reached by all the buds on a whole sympodium were determined. The process of microsporogenesis is described for the variety Navrotskiĭ of *G. hirsutum*. The pollen grains were of 2 types, some echinulate and others smooth and smaller. Degeneration of pollen grains and of pollen mother cells was also observed in this variety. These two observations both indicate the hybrid nature of the variety and the latter is of great significance with reference to boll shedding. It would seem to indicate the necessity for close inbreeding to obtain homozygosity. Inbreeding might also have the advantage of separating out recessive characters, some of which might be of great use, as in other plants—e.g. earliness, resistance to disease and various climatic factors, non-dehiscence of fruits, etc.

Large numbers of different solutions were tried for the artificial germination of the pollen but only one gave any germination at all and this was not at all successful. The testing of the pollen germination was carried out by leaving the flower overnight in a glass and examining the pollen grains the following day.

A detailed study of the embryo sac development was also made and the development is described for *G. herbaceum*. In many cases more than one embryo sac arose in one ovule, but only one of these finally developed. The whole development is extremely complicated. A detailed knowledge of the development of the female gametes is necessary for the study of the question of boll shedding and the production of artificial mutations. In connection with the latter, the correspondence between external and internal phases is being studied.

The process of fertilization was studied for the above variety Navrotskiĭ.

Cytological examinations were made on the following interspecific hybrids : *G. herbaceum* x *G. hirsutum* ; (*G. herbaceum* x *G. Nanking*) x (*G. hirsutum* x *G. barbadense*)—i.e. representatives of all four sub-groups ; *G. hirsutum* x *G. barbadense*—a valuable cross for the use in practice of the first generation hybrid ; *G. barbadense* x *G. herbaceum* ; *G. arboreum* x *G. barbadense*. These were all crosses which have proved to be of extreme interest at the Tashkent station.

In the *G. hirsutum* x *herbaceum* 13 bivalents and 13 univalents were observed, the latter passing irregularly to one pole or the other, the whole behaviour exemplifying that typical for wide crosses.

G. peruvianum in the reduction division displayed many phenomena characteristic of a hybrid—auxiliary spindles, lagging chromosomes—and half the chromosomes coloured more strongly with hematoxylin than the other half. This question will be investigated further.

656. KEARNEY, T. H. and HARRISON, G. J. 633.51:581.162.3
Pollen antagonism in cotton.
J. Agric. Res. 1932 : **44** : 191–226.

When Pima and Upland pollen are applied in mixtures to stigmas of Pima or Upland cotton, there is a selective fertilization in favour of like pollen. Experiments to determine the cause of this selective fertilization revealed the following facts : (a) when pollen of each sort is applied separately, the two kinds of cotton are entirely compatible, the Upland pollen in fact having slightly greater fertilizing ability on Pima stigmas than Pima pollen, though on Upland stigmas the like pollen is slightly favoured ; (b) there is no consistent difference between growth rate of like and unlike pollen tubes and germination tests failed to disclose marked difference in viability ; (c) there is no differential survival in favour of homozygotes, on the contrary there is a slight difference in favour of heterozygotes.

The authors conclude therefore that the presence of pollen of the same type induces a localized physiological reaction in the stigmas which renders them unfavourable for germination or growth of pollen of a different type. Some unlike pollen grains, however, are able to effect fertilization, either because they are more resistant or are so placed as to avoid the tracts of stigmatic tissue influenced by contact with like pollen. This view receives some support from an experiment which demonstrated that when like and unlike pollen are applied to opposite sides of the stigma there is a lesser proportion of homozygous plants in the resultant population than is the case with more " intimate " mixtures. The antagonism to unlike pollen is only induced by the like pollen when in a viable condition.

657. WARE, J. O., YOUNG, V. H. and JANSSEN, G. 633.51–2.484
Cotton wilt studies III. The behaviour of certain cotton varieties grown on soil artificially infested with the cotton wilt organism.
Bull. Arkans. Agric. Expt. Sta. 1932 : **269** : 51 pp.
Susceptibility was in certain cases associated with early maturity, although not by any means invariably.
Resistance did not appear to be associated with lint characters or boll and seed characters.
Various resistant varieties of different types are recommended.

658. MUNERATI, O. 633.522:575–181.13:575"793"
Una canapa nana ultra precoce. **(An ultra early dwarf hemp.)**
Ital. Agric. 1932 : **69** : 13–16.
A strain of dwarf hemp from Russia *Cannabis sativa* var. *praecox* was found to retain its characteristics in the sixth generation when grown under Italian conditions.
Although its size is not in its favour, yet on account of its extreme earliness it is able to resist attacks by broom-rape.

659. VENKATRAMAN, T. S. 633.61:575
Sugar cane breeding in different countries.
Bull. 4th Conf. Int. Soc. Sugar Cane Techn. 1932 : 44.
The paper contains a summary of the replies to a questionnaire covering the points of interest to the cane breeder. Details of plant characters of interest to the breeder, breeding technique and of the systems adopted for the nomenclature of the seedlings raised are given for each country.

660. UNITE, J. O. 633.61:575(91.4)
The present status of sugar cane breeding in the Philippines.
Sug. News 1932 : **13** : 160–66.
A brief outline of the methods used in carrying out the crossing.
Some promising seedlings of the second glagah " nobilization " have already been obtained.

661. BISSINGER, G. H. 633.61:575(96.9)
Notes on sugar cane research in Hawaii.
Sug. News 1932 : **13** : 143–49, 210–15, 278–84.
A brief description of work in progress at the various experiment stations. Ratooning receives great emphasis in the early stages of selection, in addition to disease resistance. Some of the new canes are described, together with the methods of testing them.

662. MANGELSDORF, A. J. and LENNOX, C. G. 633.61:575(96.9)
Seedling and variety work from the plantation standpoint.
51st Ann. Meet. Hawaiian Sug. Planters' Assoc. 1931.
The areas planted under different canes in the last few years are given for the different islands.
The opinions of the planters of the cane POJ 2878 are given, then other new seedlings are treated similarly.

663. MOIR, W. W. G. 633.61:575.247
Cane varieties or mutations?
Bull. 4th Cong. Int. Soc. Sug. Cane Techn. 1932: 8.
Attention is drawn to the number of very similar varieties in the collection at Pasoeroean, differing only in minor characters such as vigour, stature and waxy bloom. The presence of vegetative sports involving colour differences is a matter of general experience and the inference is that other mutants occur involving only the less obvious characters. From a collection of several hundred vigorous stools some half dozen have been isolated and compared with the standard Yellow Caledonia from which they were derived. They stand out in quickness of germination, vigour of growth and relative yield. The cause of the change is unknown but some indication of the author's trend of thought is given by his reference to seed brought to Hawaii from Lahaina after 20 years on rich alluvial soil with the result that, while giving a good plant crop, it gave a relatively poor ratoon crop, and a further reference to Striped Tip, the Yellow Tip mutations of which are found mainly on good pockets of soil while the Red Tip mutations are only found on poor shallow soiled knolls and hill-sides.

664. BREMER, G. 633.61:576.312.35:576.16
On the somatic chromosome numbers of sugar cane forms and the chromosome numbers of indigenous Indian canes.
Int. Sug. J. 1932 : 34 : 223–24.
An abridged account, in English, of the work referred to in " Plant Breeding Abstracts " Vol. II, Abst. 471.

665. MENDIOLA, N. B. 633.61:608.3
Should new sugar cane varieties be patented.
Philipp. Agric. 1932 : 20 : 686–87.
The author's reply is printed in connection with the questionnaire circulated by the International Society of Sugar Cane Technologists. He is in favour of canes of known parentage being patentable.

666. DAVIS, R. L. 633.61–2.8–1.521.6:575
Sugar cane seedling mosaic elimination.
Bull. 4th Conf. Int. Soc. Sugar Cane Techn., 1932 : 19.
The paper describes a system of planting in rows parallel to the prevailing wind with an infected plant of a susceptible variety at the head of each row. Under such circumstances interplanting with sorghum is unnecessary. Information is given of the selection of seedlings of the two crosses POJ 2725 x S.C. 12/4 and Mayaguez 9 x POJ 1364. Effective elimination of susceptible seedlings is possible when the centres of primary infection are 50 ft. apart but for the elimination of the moderately susceptible forms the foci must be closer or exposure to infection must be retained over several crop seasons.

667. DAVIS, R. L. 633.61–2.8–1.521.6:575.127.2
Sugar cane crosses with Kassoer selfs.
Bull. 4th Conf. Int. Soc. Sugar Cane Techn., 1932 : 18.
Two of six seedlings of Kassoer selfed presented to the Mayaguez station by Dr. Brandes were crossed with POJ 2725. Comparative observations of the seedlings showed definite differences between the two sets of seedlings. Both progenies were resistant to mosaic. Of the two parents of Kassoer stock, U.S. 541 and U.S. 785, more than double the number of seedlings must be grown of the former to obtain medium girth plants ; advantage lies with U.S. 785 for prolificness, height and cane weight per stool. U.S. 541 transmits a tendency of the leaves to cling strongly while U.S. 785 and its progeny shed their leaves almost freely. Sucrose content and total solids are satisfactory in both progenies.

668. CLAUS, E. 633.63:575
Tagesfragen der Zuckerrübenzüchtung. (**Present-day questions in breeding sugar beet.**)
Zbl. Zuckerind. 1932 : **40** : 347–52.

The author first discusses in how far it is possible to increase yield by reducing the variability. It has not yet been proved, the author remarks, that genotypic uniformity will reduce the variability of the sugar beet and the author's own experiments shewed that no reduction in variability resulted from self-pollination as opposed to free pollination. The disadvantages attendent upon homozygosity are pointed out and it is further emphasized that a rise in yield is to be attained not by reducing the variability but by raising the average for the whole population. This is to come about by breeding sorts adapted to particular growth conditions. In this respect, in view of climatic variability, a mixed population is often superior to a uniform one.
In attempts to breed a winter beet, lines capable of withstanding the winter of Central Europe have been obtained and great differences in proportion of " bolters " have been observed. Such lines proved entirely resistant to insect attack.
As difficulties in the way of breeding non-bolting strains are the facts that the character is recessive and apparently somehow linked with high sugar content. The author has shewn that very material reduction in bolting can be made, however, by breeding.
The property of developing the root out of the ground, found in common sugar beet, appeared not to be hereditarily transmissible. Plants of this character have been obtained, however, by crossing with the forage beet.
By crossing with the wild beets no profitable results have yet been obtained. Crosses with mangold (*Beta cicla*) have also been made with the object of increasing the leaf surface ; this has been done but so far the desired root type has not been attained in these crosses. Crosses within the sugar beet are thought to be the most profitable.

669. RASMUSSON, J. 633.63:575.12:576.16
Några undersökningar över *Beta maritima* L. (**Some investigations on *Beta maritima* L.**)
Bot. Notiser 1932 : 33–62.

In Scania, the sugar beet is near the limits of its region of cultivation and as the modern types are selections from warmer climates it seemed desirable to make a study of the wild forms of *Beta maritima* occurring in the district in the hope of finding types suitable for crossing with the sugar beet.
A good deal of variation was found in leaf type. The stems were mostly prostrate and often coloured red with anthocyanin. An advanced phylloidy was quite common. Most of the plants had typical *Beta maritima* roots, the variation seemed to depend chiefly on the locality. Three roots were deep red coloured and were almost without lateral roots and were probably the result of crossing with forage beet.
Most of the plants had the typical wild character of shedding their fruits with great ease. Much greater self-fertility was noticed than in cultivated beets.
Seeds of these plants were sown, the morphological features of the progeny are described and the sugar content of their roots determined.
Beta maritima is obviously open to pollination by sugar beet, soil and climatic factors tend, however, to maintain the type.
The sugar content of the roots varies from one family to another, but the average is greater than that of forage beet though considerably inferior to sugar beet.
The dry matter content is nearly as high as that of sugar beet and very much greater than forage beet. The ash content is higher than either.
The Atlantic type of *Beta maritima* differs from the Mediterranean type, especially in flowering first in the second year while the latter flowers in the first year after sowing.
There are two possible methods for the production of sugar beet. One is by selection from the wild *Beta maritima* and the other is by crossing the wild type with the cultivated varieties.

633.63:576.354.4
670. PRYWER, C. 633.63:576.356.1
Badania cytologiczne nad burakiem cukrowym (*Beta vulgaris* L. v. *saccharifera*)
[Cytological studies in the sugar beet (*Beta vulgaris* L. v. *saccharifera*).]
Acta. Soc. Bot. Polon. 1931 : **8** : 19–46.

A diploid number of 18 was observed. Morphological differences between the individual chromosomes are described.
Much abnormality was observed in the meiotic divisions, only 2 of the 10 plants observed being quite normal. The formation of diploid gametes was observed both by the suppression of the first division and by the fusion of 2 spindles in the homotypic metaphase.
These abnormalities are thought to be the result of changes of temperature during fixation.

671. HENIKA, F. S. 633.71:575.11.061.6
The inheritance of the White Burley character in tobacco.
J. Agric. Res. 1932 : **44** : 477–93.

Inheritance of the chlorophyll-deficient White Burley character in crosses of White Burley with normal green tobaccos is explained on the basis of duplicate factors designated $G_1g_1G_2g_2$, giving a 15 green : 1 white ratio in F_2.
Deficiencies in recessives in field and greenhouse plantings are probably caused by differential zygotic viability between the dominant green and recessive white genotypes.

672. KOSTOFF, D. and KENDALL, J. 633.71:575.12:576.356.5
The progeny of a heteroploid (*N. tabacum* x *N. Rusbyi*) x *N. tabacum* plant.
Genetica 1931 : **13** : 17–26.

The F_1 of the cross *N. tabacum* var. *macrophylla* x *N. Rusbyi* are self-sterile but can be easily backcrossed to *N. tabacum*. The progeny of this backcross was very variable, in their morphological and cytological features and in fertility. One plant had 28 chromosomes at the first metaphase of the pollen mother cells and 52–54 in both plates of the second division. This plant was selfed and from the progeny one plant was chosen with 27 chromosomes at the first metaphase and 53–54 chromosomes in both plates of the second division. A description is then given of the progeny of this plant which shewed great variation both externally and cytologically. Besides the parent forms, new forms appeared and provide another example of the importance of hybridization in evolution.

673. BUNKER, F. H. 633.71:575.42(72.95)
La selección de semilla de tabaco en Puerto Rico. **(Seed selection of tobacco in Puerto Rico.)**
Bol. Agric. Colombia, 1931 : **4** : 293–96.

The advantages of cultivating a reduced number of standard pure varieties are pointed out; two selected varieties, which have been developed from the native tobaccos are said to have given excellent results and further selections and nybridizations are being made.
The method to be used by the cultivator for keeping these varieties pure is described.

674. WELLENSIEK, S. J. 633.72:575.42
Selectieve Uitdunning bij Thee. **(Selective thinning-out in tea.)**
De Bergcultures, 1932 : **6** : 225–28.

Two experiments on the application of selective thinning based on the results of quantitative yield determinations are described. In the first experiment the plants which appeared likely to be the poorest were marked; the yields of all the plants were then taken in four pickings. The individual yields varied from 10 to 120 g. and 17·7 per cent of the plants were below 28; 33·9 per cent of these plants only corresponded to those which would have been discarded in the eye examination.

In the second experiment the marginal plants were treated separately from the rest and their average yield proved to be 50 per cent higher than the rest. The correspondence between the two methods of judgment was 20 per cent in the case of the marginal plants and 28·8 per cent in the rest. A calculation shews that a correspondence of half this amount (15 per cent) would occur in two random samples. This shews that the only sound method is by the use of the direct yield tests.

These are extremely costly and the author is of the opinion that selective thinning of any kind does not pay and that it is more profitable to wait until selected material of a uniformly high quality is available for planting.

675. *Lambers, M. Hille Ris 633.73:575(92.2)

Vijf jarr selectiewerk op Soember Asin September 1926—October 1931. **(Five years of selection-work at Soember Asin, September 1926—October 1931.)**

Arch. Koffiec. Ned-.Ind. 1932 : **6** : 1–42.

The objects of breeding are to improve first the yield and then the quality. Adaptation to a wide range of growth conditions and to special conditions is also of importance.

First of all the author reviews the work before his arrival, up to 1926, mostly consisting in a search for plants resistant to the leaf disease. The introduction of *robusta* in 1900 gradually replaced the other types.

After 1926 various lines of improvement were started simultaneously—superior mother trees were tested by grafted progeny and seedling progeny, hybridization and studying the progeny of known hybrids, so as to find the parental combination giving the best progeny. Mixed plantations of such special combinations might give good results.

Foreign pollen penetrates more rapidly than self pollen and so a considerable number of hybrids can be expected.

All the *robustas* are very heterozygous and hybridization leads to very heterogeneous progeny. The technique of hybridization is discussed.

The results of cross-pollination in certain combinations of *robustas* were better than those from free pollination. In some cases the success of reciprocal crosses was quite different, the size of bean was in each case determined entirely by the seed parent. Certain *arabica* x *robusta* hybrids shew possible promise of combining resistance to leaf disease with high quality.

Crosses have been made between individuals possessing different desirable qualities and between individuals possessing the same, the latter to produce uniform progeny. It is thought probable that crosses within the *robusta* variety will give the best results.

Yield tests over a period of six years shewed that only very few retained a uniformly high yield over the whole period. The best numbers in this respect are noted and the outstanding numbers are described.

Seed of the best numbers will be obtained from the interior of grafted plots, so as to be as nearly as possible self-pollinated. Yields of 19 and 20 picols per bouw were obtained from grafted and seedling progenies of some of the best numbers as compared with an average of 5 picols per bouw for the estate as a whole.

676. Wildeman, E. de 633.74:581.162.5

À propos de stérilité chez des Cacaoyers. **(Sterility in Cacao.)**

Rev. Bot. Appl. Agric. Trop. 1932 : **12** : 173–79.

The author calls attention to a number of recent papers, notably by Haigh and Wellensiek (see " Plant Breeding Abstracts " Vol. I, Abst. 269 and Vol. II, Abst. 288) and the importance which further studies on these lines would have for cacao production in the French colonies in Africa and the question of the hybrid origin of the cacaos.

* A full summary of this paper is on file at the Bureau.

The gradual degeneration of so many cacao varieties may be due to out-pollination from inferior types. It is also pointed out that hybrid plants, although often possessing greater vegetative vigour, frequently produce less abundant fruit. Many tropical plants have gradually lost their male organs and it is not impossible that a similar process is in progress at the present time in cacao.
The author is also of opinion that vegetative propagation tends to diminish the fruit formation and desires efforts to be made towards the establishment of lines which are propagated by self-pollination rather than vegetatively. A sketch is given of the kind of researches this will involve.

677. ERWIN, A. T. 633.842:581.162.3
Anthesis and pollination of the Capsicums.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : p. 309.
The plants are both self and cross-fertile, considerable out-pollination by means of insects being observed.

678. TESHIMA, T. 633.853.74:575.11.061.6:581.48
Inheritance of the colour of seed coat in Sesame.
Proc. Crop. Sci. Soc. Japan 1931 : **3** : 232–36.
In addition to black and white, forms with yellow, brown and yellowish-brown seed coats have been observed. Many of these proved to be heterozygous.
The black was dominant to white but a complex segregation occurred in F_2. Different shades of intermediate colours appeared. The ratio of black : intermediate : white being 180 : 255 : 8. This conforms rather closely to a trihybrid ratio 27 : 36 : 1. A complex segregation also occurred in F_3.
Homozygous white, yellow, brown, yellowish-brown and black plants were intercrossed and again complex ratios were obtained.
The results of the various crosses are tabulated.

679. WAGNER, S. 633.854.78:575.127.2
Artkreuzungen in der Gattung *Helianthus*. (**Species crosses in the genus *Helianthus*.**)
Z. indukt. Abstamm.–u. VererbLehre. 1932 : **61** : 76–146.
Innumerable interspecific hybrids of *Helianthus* have been described and many naturally occurring species are regarded as of hybrid origin.
The chromosome numbers of the species used were determined and were : *H. cucumerifolius*, n = 17, *H. rigidus*, *macrophyllus* and *tuberosus* n = 51.
The set in the crosses of *H. cucumerifolius* with *H. rigidus* and *H. macrophyllus* was relatively good, with *H. tuberosus* not so good. These crosses all succeeded better than crosses between the 51 chromosome species or different species with 17, such as *H. cucumerifolius* x *annuus*. The reciprocal crosses were all much less successful.
The hybrid seeds germinated as successfully as selfed seeds of the pure species although in *H. cucumerifolius* x *tuberosus* the hybrid seeds germinated less rapidly and less regularly.
The cotyledons of the different species were very distinct and are described. The hybrids of *H. cucumerifolius* x *macrophyllus* had cotyledons almost entirely of the paternal type, the cross with *H. tuberosus* on the other hand shewed all intermediates between the one and the other parental type, the majority being intermediate.
The mature plants of *H. cucumerifolius* x *rigidus* resembled the paternal type, those of the cross with *macrophyllus* were of two types, dwarfs and normals, both of the paternal type in leaf characters, in the ratio 1 : 1. The progeny from *tuberosus* was very irregular ; many of the hybrids were of normal vigour and strongly resembled the paternal parent, others were dwarfs, and all intermediates between these two were observed, in quite irregular proportions ; the type of mature plant also seemed to be independent of the cotyledon type.

A comparison was made of the plants described in the three above crosses as of paternal type with the corresponding paternal parent. With respect to leaf characters although in the mass the paternal characters were completely dominant, individual characters did shew the influence of the female parent. In the case for the leaf length/breadth index whose variation was studied by statistical methods, the differences were significant. A similar influence of the maternal parent was observed in the floral characters and the time of flowering. The influence of the female was most clearly visible in the cross *H. cucumerifolius* x *rigidus*, least in *H. cucumerifolius* x *macrophyllus*.

The patroclinous hybrids formed rhizomes and tubers corresponding to the paternal parent in the crosses *H. cucumerifolius* x *macrophyllus* and x *tuberosus*, somewhat less than the paternal parent in the cross *H. cucumerifolius* x *rigidus*.

Backcrosses of the *H. cucumerifolius* x *rigidus* hybrid with the parents shewed that it was partially fertile both in the male and female gametes ; the backcrosses with the *rigidus* parent were less successful than with the other parent.

Similarly with the *macrophyllus* backcross, except that the fertility seemed to be greater in the pollen than in the egg cells. The set was clearly greater than in the former backcross when the hybrid was used as female parent, no set at all was obtained when it was used as pollen parent.

The success was greater with the *macrophyllus* than with the *cucumerifolius* parent.

The pollen of the hybrid with *tuberosus* appeared to be sterile in backcrosses but gave unexpectedly good results when used to pollinate the hybrid *H. cucumerifolius* x *macrophyllus*.

The *rigidus* hybrid was the only one which set seed by self-pollination or by crossing sister plants.

From all these results it is clear that there is a greater compatibility between *H. cucumerifolius* and *H. rigidus* than between the other species and that *H. tuberosus* is comparatively distantly related. It is also clear that the parent with the larger chromosome number exerts more influence on the progeny than the other parent.

680. JANSSENS, P. 633.855.34(67.3 + 67.5)
Variétés de palmiers *Elaeis* au Congo Belge et dans l'Angola. (***Elaeis* palm varieties of the Belgian Congo and Angola**).
5th Cong. Int. Agric. Trop. 1930 : 832–45.

The yields of a number of varieties of *Elaeis* are given. Particularly good plams were found in the region of Quissima in Angola and the author is of the opinion that these should make the best material for selection for high yields.

681. KALASHNIKOV, V. M. 633.913:575
[A contribution to the methodics of breeding the guayule (*Parthenium argentatum* **Gray).]**
Bull. Appl. Bot. Genet. and Plant-Breed. 1931 : **27** (2) : 489–560.

Observations on the biology of flowering and the methods of pollination are continued. Cross-pollination from another plant is more successful than self-pollination, but both self-sterile and self-fertile lines have been observed.

Both cross and self-pollination occurs in nature and a closer study of the question of inbreeding is thought profitable and desirable.

682. LANTZ, H. L. 634.1/7:575:578.08
Fruit breeding : a method of recording and analysing data.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 97–102.

The method of making tabular records is described. These records give valuable information on the relative value of the different varieties as parents.

683. GENTA, A. 634.1/8:575.1:581.192
El análisis químico de las frutas de citrus y uvas aplicado a los trabajos de genética frutal que realiza la Escuela experimental de Agronomía de Salto. (**Chemical analysis of citrus fruits and grapes applied to the works of fruit genetics carried out by the Experimental School of Agronomy at Salto.**)
Rev. Fac. Agron. Montevideo 1931 : **5** : 279–85.
The results of analysis shewed that within a single grape variety variations existed in the percentage glucose and acid content. The same was observed in the case of citrus and the author points out that selection should be based on such factors as these rather than on external appearance.

684. TOENJES, W. 634.11:575(77.4)
Recommend two new apples for special markets.
Quart. Bull. Mich. Agric. Expt. Sta. 1932 : **14** : 198–99.
Two new seedling varieties are described. The first is Lodi, from a cross of Montgomery and Yellow Transparent, a very promising variety, much later than the normal.
The second is Milton, from a cross of Yellow Transparent and McIntosh. This variety matures at the same time as Wealthy and may replace it.

685. EDGECOMBE, S. W. and LANTZ, H. L. 634.11:575(77.7)
Apple breeding : statistical analysis of apple breeding material.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 93–96.
Results shew that Delicious, Jonathan, Grimes, when pollinated with certain varieties give seedlings of low vigour and the best seedlings are only produced by pollinating with a variety known to be suitable.
Other varieties give vigorous seedlings independently of the pollinator (Antonovka) and others always produce seedlings of low vigour.
The power of transmitting desirable grade was different in different varieties, the varieties being classed in 4 groups.

686. NEBEL, B. R. and TRUMP, I. J. 634.11:575.18
Xenia and metaxenia in apples. II.
Proc. Nat. Acad. Sci. Wash. 1932 : **18** : 356–59.
Metaxenia was investigated in apples from a tree of McIntosh pollinated with Yellow Bellflower and Red Astrachan.
The mean and standard deviation in the height of the apples of both groups was the same.
There was a slight difference in the breadth of the apples in favour of the Red Astrachan cross.
The weight of the apples was significantly larger in the same cross and the acidity slightly greater as measured both by pH values and titration.
The seeds of both groups shewed xenia.
The length of seed was greater in the Yellow Bellflower cross.

687. OVERHOLSER, E. L. and OVERLEY, F. L. 634.11:575.252:581.162.3
Pollination of certain apple bud sports in North Central Washington.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 74–77.
The results of various varieties used as pollinizers for various other varieties are given and shew that the varieties which are bud sports behave very much as their respective parents.

688. NICHOLS, H. E. and LANTZ, H. L. 634.11–2.111–1.521.6:575.1
The persistance of winter injury in certain Delicious hybrids.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 103–06.
Varying degrees of injury were displayed by different varieties in a severe frost in 1925. Twenty-two hybrids resulting from crosses of Delicious with nineteen different varieties were tested.

The hybrids with a hardy variety such as Antonovka or Anisim were much less damaged than those with tender varieties. There is a close correlation between the degree of damage and the percentage of trees damaged in the hybrids and the corresponding values in the parents.

689. DANIEL, L. 634.13:575.257:634.14
Le *Pirocydonia claraci* L.D. (**The *Pirocydonia claraci* L.D.**)
C.R. Acad. Sci. Paris 1932 : **194** : 30–32.
A new graft hybrid between the pear and quince is described. The hybrid is very vigorous and it is hoped may serve as a stock for pears.

690. SLATE, G. L. 634.22:581.162.52
Self-unfruitfulness in *Prunus tomentosa*.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 112–13.
Experiments designed to test the point proved that *Prunus tomentosa* is self-unfruitful, with the exception of four yellow foliaged types. The germination of the pollen was perfectly good.

691. KRÜMMEL, H. 634.23:581.162.3
Weitere Untersuchungen über die Befruchtungsverhältnisse bei Kirschen.
(**Further investigations on pollination in cherries.**)
Gartenbauwiss. 1932 : **6** : 262–302.
The recent literature is reviewed in some detail. The aim of the present investigations is to add to the data available and to repeat for a second year the experiments of Kamlah.
On the whole the sweet cherries proved to be self-sterile. In cross-pollinations nine new inter-sterile pairs were found. The tetraploid cherries for the most part proved to have only a limited value as pollinators of the sweet cherries. There was great variation when the sweet cherries were used as pollinators of the tetraploids.
A number of sweet cherry trees, believed to be of the same variety, were tested by pollinating. In two cases there was self-fertility.
The varietal characteristics must be taken into consideration when calculating the percentage yield from free pollination on test branches.
Experiments on the effect of external conditions shewed that temperature is the factor most influencing the duration of pollination.

692. JOHNSTON, S. 634.25:575(77.4)
New peach recommended for limited plantings.
Quart. Bull. Mich. Agric. Expt. Sta. 1932 : **14** : 199–200.
A promising new hybrid is described under the name Halehaven. It resulted from a cross of J. H. Hale and South Haven. It is very similar to the latter variety but much better coloured.

693. SHAMEL, A. D., POMEROY, C. S. and HARMON, F. N. 634.25:575.252
Bud variation in peaches.
Circ. U.S. Dept. Agric. 1932 : **212** : 21 pp.
As a result of systematic study of the orchards large numbers of off-types have been observed, both as whole-tree variations or limb variations and some of them are described. Many of the variants are earlier than the normal and one even ripened before the earliest canning variety of all, Tuscan, which it may possibly replace, being superior in certain other characters. Late maturing and various other variants are described, some being more productive than the normals from which they have arisen, others being superior in shape, size, texture, colour, etc., and there remains no doubt that improved types can be originated by selecting these bud variants, most of which were shewn to be capable of propagation by budding.

694. SWINGLE, W. T., ROBINSON, T. R. and SAVAGE, E. M. 634.3:575.127
New citrus hybrids.
Circ. U.S. Dept. Agric. 1931 : **181** : 19 pp.
The tangelo is a hybrid between tangerine [*C. nobilis deliciosa* (Ten.) Swingle] and grape fruit [*C. grandis* (L.) Osbeck]. Descriptions are given of the original varieties Sampson, Thornton and Williams.
The excellent appearance and quality of these led the authors to make a considerable number of further crosses with the object of extending the range of types and of times of maturity and to obtain forms resistant to citrus scab, suitable for transport and possibly also seedless forms. Descriptions are given of a number of these new varieties, each of commercial promise and differing in time of maturity.
The tangelos are more like the orange than their parents but are characterized by soft melting pulp of very fine flavour and aroma. The seed develops entirely from the mother tissue and so they breed true.
Certain seedlings obtained by backcrossing on to grapefruit are described. Some of these are also of great interest from a more limited standpoint.
Some of the tangors, hybrids between the mandarin orange (*C. nobilis*) and the common orange (*C. sinensis*) closely resemble the tangelos. Some of the limequats, hybrids between lime and kumquat have proved to be hardy and immune from withertip, otherwise like the ordinary lime. A hybrid between the calamondin (*C. mitis* Blanco) and the citrange has proved more hardy than the calamondin parent or any citrus of good quality and is being successfully grown in quite northern latitudes ; it is quite free from the unpleasant flavour of the citrange. A lime-lemon hybrid is of great value in being resistant to lime withertip and citrus scab and will probably be a good lemon substitute for hot, humid districts.

634.3:581.163
695. WEBBER, H. J. 634.441:581.163
The economic importance of apogamy in citrus and mangifera.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 57–61.
The degree of apogamy in various citrus varieties commonly used as rootstocks is given. Many F_1 hybrids of widely different species shew exceptional vigour and are of great value as rootstocks ; they also exhibit a high degree of apogamy, frequently 100 per cent. Highly uniform seedlings for rootstocks should thus be obtained in this way. The small proportion of sexually produced seedlings can usually be detected by their smaller size and removed.
The high degree of apogamy in certain mango varieties makes their seedling propagation as safe as by grafting.

696. WEBBER, H. J. 634.3:581.163:575.42
Effect of selection within apogamic and clonal progenies.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 53–56.
Large numbers of seedlings of like genetic constitution can be obtained by apogamy but these seedlings nevertheless exhibit considerable variation in size, in fact the greatest range of variation (91·03 ± 6·08) was observed in the Sampson Tangelo which is known to give only apogamic seedlings. These differences tended to disappear with increasing age of the trees but noticeable differences persisted to the eighth year.
Although these variations are recognized as being not hereditary yet the increased yield in the first few years of production on the largest seedlings justifies the selection of these trees, especially for use as rootstocks.

697. TOXOPEUS, H. J. 634.3–1.541.11:581.163
Selectie van onderstammen uit zaaisels van Japansche citroen en van *Citronella* (rough lemon). (**Selection of seedling stocks in citrus.**)
Landbouw 1932 : **7** : 843–50.
Seedling stocks from the same mother tree differ markedly in their effect upon a given scion, owing to the heterozygous nature of the trees from which they arise. This makes the plantations very irregular.

If, however, only those seedlings which have arisen apogamously are chosen, then an exceedingly uniform lot of stocks can be obtained. With *Citronella* all but about 4 per cent of the seedlings arise vegetatively in this way. In the Japanese citron not more than 40–50 per cent are vegetative and more care is required in choosing them. A table is given in which various characters by which the vegetative seedlings can be identified are indicated. Amongst other things they are more vigorous in growth.
The greatest differences ever observed between individuals vegetatively produced in this way are illustrated, comparing them with the very marked difference between the true " generative " offspring.

698. SHAMEL, A. D. 634.334:575.252
A pink-fruited lemon.
J. Hered. 1932 : **23** : 23–27.
A variegated form which frequently arises in the Eureka variety is described. It is less productive than the normal type and is used mostly as an ornamental plant. The pink-fruited form is similar to these variants in every other character and is thought to be a bud variant.

699. GONZALEZ, L. G. 634.431
An improved seedling variety of chico (*Achras zapota* Linn. var. *ponderosa*).
Philipp. Agric. 1932 : **20** : 604–05.
A seedling variety with exceptionally large fruits is described. The difference between this variety and the ordinary native type is thought to be hereditary.

700. YARNELL, S. H. 634.71:575:576.356.5
Chromosome behaviour as a factor in berry breeding.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 114–17.
The origin of the Nessberry by chromosome doubling in a sterile hybrid between the wild dewberry, *Rubus rubrisetus* and the red raspberry, *R. ideaus* var. *strigosa*, is briefly described.
Various crosses of this tetraploid have been made with ordinary diploids, producing sterile triploid hybrids. Certain fertile flowers have occurred, however, and the offspring from these have proved to be either diploid or tetraploid. Some of these are completely fertile, others partially sterile, depending on the degree of relationship between the species contributing to their composition. The sterility resulting from this cause is more pronounced in the diploids than the tetraploids. However, several tetraploids also were completely sterile.
The occurrence also of maternals is not infrequent.

701. HARDY, M. B. 634.711.3:575.12:578.08
Red raspberry pollination technique.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 122–24.
The methods used in emasculation, bagging and pollination are described. Emasculation had little or no deleterious effect on the setting of seed.

702. HARDY, M. B. 634.711.3:581.162.5
Self and cross fertility of red raspberry varieties.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 118–21.
Only in one out of the many crosses performed was there any sign of even partial cross-sterility. Other varieties were almost entirely cross-and self-fruitful and failures to set seed were usually due to faulty technique of pollination.

703. SLATE, G. L. 634.75:575
The best parents in strawberry breeding.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 107–11.
The percentages of plants selected from crosses involving various parental combinations are shewn. It is very clear that the best parental variety is Howard (Premier), which gave outstanding results in almost every cross. It tends to transmit smooth fruit, regular in shape, very glossy.
Crosses involving hybrids of Howard were less successful.

704. RYGG, G. L. and DARROW, G. M. 634.75:575.18
Paternal and maternal inheritance in *Fragaria*.
Science, 1932 : **75** : 269–70.
Amongst a set of 2,015 seedlings from a cross of two varieties having the same chromosome number 37 plants entirely resembling the male parent were observed. The same phenomenon was observed in other sets of seedlings, in all 1·2 per cent of the total number of seedlings. Such plants were smaller than the parent, resembled the wild type and were almost sterile.
Certain cases of maternal inheritance were also observed in crosses with the same variety, this time used as female parent.

705. VIEUCEUS. 634.885.094
Hybrides producteurs et *Phylloxera*. (**Hybrid producers and *Phylloxera*.**)
Rev. Vitic. Paris 1932 : **39** : 133–36.
The author has observed a diminished relish on the part of the consumers of " vin ordinaire." The author ascribes this to the uniformity in quality resulting from the increased use of direct producers and fears that the same cause will lead the public ultimately to abandon this beverage completely.

706. SNYDER, E. 634.851.093
A preliminary report on the breeding of *Vinifera* grape varieties.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 125–30.
Twenty-one crosses have been made and the results of the various combinations are tabulated. The number of reflex stamens appearing in the progeny of different parents varied. The colour in the progenies of various combinations is indicated. The shape of fruit tends to resemble that of the parents, size was mostly intermediate between the parents.
The muscat flavour of Alexandria has not been reproduced in any of the seedlings so far.
The production of seedless varieties has received most attention, six different seedless varieties having been used as male parents. Up to now three seedless seedlings have been produced.

707. ALLARD, H. A. 634.972:575.127.2
A progeny study of the so-called oak species *Quercus Saulii*, with notes on other probable hybrids found in or near the district of Columbia.
Bull. Torrey Bot. Cl. 1932 : **59** : 267–77.
A description of several naturally occurring hybrid forms and suggestions as to their parentage.

708. JENKINS, J. M. (Jr.) and MILLER, J. C. 635.263:575.42
Some factors influencing the reproduction of shallots.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 315–17.
Differences were observed between strains in respect of the number of seed stalks produced, in the time taken for these to be formed, in attack by *Botrytis cinerea* and various other characters. There is evidently a considerable field for selection.

709. Pearson, O. H. 635.34:575.125" 793 "
The influence of inbreeding upon the season of maturity in cabbage.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 359–66.
Inbred lines were compared with the hybrids between them. The crosses involving unrelated lines gave an increase in earliness, this difference was not observed in crosses of closely related lines.
The yields shewed similar relationships.
There are indications that in some cases earliness is governed by definite genetic factors.

710. Porter, D. R. and Melhus, I. E. 635.615–2.484–1.521.6:575
The pathogenicity of *Fusarium niveum* (EFS.) and the development of wilt resistant strains of *Citrullus vulgaris* (Schrad.).
Res. Bull. Iowa Agric. Expt. Sta. 1932 : **149** : 125–84.
Investigations were made on the pathogenicity of the organism, the factors determining infection and measures of control.
If the varieties of *Citrullus vulgaris* are divided into edible and relatively inedible then the greatest relative resistance is found among the latter varieties.
Selections were made of Kleckley Sweet, an edible commercial variety and resistant strains were isolated. One proved approximately 50 per cent resistant and was distributed as the Pride of Muscatine.
Crosses were also made between edible susceptible and inedible resistant varieties as well as with Conqueror, a variety bred from Stock Citron x Eden and assumed to be wilt resistant but which proved to be only slightly more resistant than Kleckley Sweet.
The most successful cross was White Seeded, an inedible variety, x Halbert Honey. Plants from a selection of this cross varied in resistance from 63—91 per cent. At the moment the strain is poor in eating quality but it is hoped to improve this by further selection.

711. Lindstrom, E. W. 635.64:575.116.1
First-chromosome genes in the tomato.
Genetics 1932 : **17** : 351–57.
Data from the F_1 of a cross between the quadruple dominant and quadruple recessive for the following genes located in the first chromosome, Dd (tall-dwarf growth habit), Pp (smooth-pubescent epidermis), Do (oblate-ovate, major fruit shape) and Ss (simple-compound inflorescence), reciprocally back-crossed to the recessive parent, showed three sets of single and two sets of double cross-overs ; the linear order of the genes was D—P—O—S. There was no significant difference between amount of crossing-over in micro- and mega-sporogenesis.
Fruit size is probably associated with a size gene situated very near the Oo locus. Although direct proof is lacking there are indications that the Ss genes not only control type of inflorescence, but also influence number of flower clusters, number of nodes and leaves between various clusters on the main stem, and beaking of fruit.

712. Stair, E. C. and Macgillivray, J. H. 635.64:575.42
A study of the regions of the tomato fruit as affected by selection.
Proc. Amer. Soc. Hort. Sci. 1931 : **28** : 350–52.
Alternative lines were selected, one for high fruit wall and the other for low but no appreciable differences resulted in the selected lines. Similar results were obtained for concentration of fruit juice and the percentage of waste.

713. Lindstrom, E. W. 635.64:576.356.5
A fertile tetraploid tomato.
J. Hered. 1932 : **23** : 115–22.
Ordinary tetraploids formed from the diploid *Lycopersicum esculentum* are characterized by poor seed development. Tetraploids from *L. pimpinellifolium* are here reported, produced by the callus method from a homozygous plant. These tetraploids were highly fertile and chromosome association was almost entirely in the form of bivalents, very few tetrasomic groups being

observed. The plants were larger and more vigorous than the diploid and the flowers and pollen grains considerably larger. Some sterile plants occurred but the fertile plants had fruits twice the size of the diploid, with abundant seed formation. The tetraploids have remained constant over three generations.
In crosses with the diploids, fruits, but without seeds, were set.
In the progeny of the selfed tetraploid certain yellow fruited plants appeared and the inheritance of this character indicated that pairing might occur between any of the four chromosomes or of the eight chromatids.

714. JANAKI-AMMAL, E. K. 635.646:576.356.5
A polyploid eggplant, *Solanum melongena* L.
Pap. Mich. Acad. Sci. 1931 : **15** : p. 81.
Unfruitful plants appearing in an F_2 progeny were observed to be gigantic. A similar plant later appeared also in the F_1 of another cross. This plant was examined and proved to have 36 in place of the normal 24 chromosomes. It produced one small fruit only.

715. MURATOVA, V. S. 635.651
[Common beans (*Vicia Faba* L.).]
Suppl. 50 Bull. Appl. Bot. Genet. and Plant–Breed. 1931 : 298 pp.
The systematics of the species are treated in some detail.
The present work is based on the study of 1,217 samples collected from all places where the plant is cultivated.
An extensive study was made of the variation of a number of characters ; the present classification is based on these characters and the geographical distribution, subspecies, varieties and sub-varieties being established, the latter being divided into forms. A key to these is given.
The types found in various geographical areas are indicated.
An indication is given of the archeological findings and the literature on the origin of the cultivated forms is reviewed. The wild species most closely related to the cultivated bean are distributed in the area corresponding to the ancient Mediterranean. This together with the botanical and systematic examination of the collection of cultivated forms has led to the establishment of the Atlantic coast as the western and the Himalayas as the eastern limit of the species. Archeological evidence supports this conclusion, indicating that the small-seeded group is the most primitive. This group also possesses characters unknown in the other group and displays a much greater degree of variation in those characters which are common ; its area of distribution is more extensive. The large-seeded group is unknown in archeological findings and does not extend eastward beyond Western Persia.
The greatest diversity of morphological characters, period of maturity etc., is found in the eastern region of the area of distribution, between the Hindu Kush and the Western Himalayas, and South-western Asia is regarded as the main area of development of the species. The Mediterranean is regarded as the centre of development of the large-seeded group.
A brief outline is given of the breeding and genetics done on the crop in Germany and neighbouring countries. Breeding in the U.S.S.R. is just beginning, yield, earliness and non-shedding being the desiderata.

716. SVENSSON, V. 635.652:575
Förädlings– och försöksarbetet med bönor å Weibullsholm. (**Breeding and experimental work with beans at Weibullsholm.**)
Weibulls Årsbok 1932 : **27** : 23–29.
Contains a description of varieties bred and selected at Weibullsholm.
A species cross has been made between *Phaseolus multiflorus* and *P. vulgaris* in the hope of producing a hybrid more resistant to night frosts.

717. LAMPRECHT, H. 635.652:575.11:581.47
Beiträge zur Genetik von *Phaseolus vulgaris* II. Ueber Vererbung von Hülsenfarbe und Hülsenform. (**Contributions to the genetics of *Phaseolus vulgaris* II. The inheritance of pod colour and form.**)
Hereditas, 1932 : **16** : 295–340.

The results of previous writers are discussed and summarized. The results of the author's own crosses are then presented.
In the F_2's of the crosses under investigation there was a clear monofactorial segregation of green and yellow pods, with the former dominant. There was frequently a deficit in the number of yellow segregates, but the degree of this was different for the different crosses, one cross having the full number. The author concludes that the yellow factor is also responsible for a greater tenderness at the time of germination but that this effect is in certain crosses overshadowed by the action of other factors.
The F_2 of certain crosses between two varieties with smooth pods contained pods with constrictions between the seeds, these being present in proportions indicating a bifactorial constitution, the plants with constricted pods being the double recessive. There were also plants with slightly constricted pods, indicating the partial action of the absence of one of the factors in the presence of the other. Further crosses however gave ratios of 1 : 63 and so indicated that three factors are really responsible for the normal type. In a third type of cross 9 : 7 ratios were obtained, indicating the presence of two factors, both of which were required to produce the normal. A fourth factor is assumed, this time a basal factor whose presence is necessary for the production of the normal type at all, probably the factor governing the formation of the collenchyma under the epidermis and which prevents the indentation.
Straight pods behaved as a simple dominant to curved in some crosses, in others 9 : 7 ratios appeared and in still others 15 : 1. Again therefore, one basal factor is assumed, and two further factors each of which gives straight pods in presence of the basal factor.
For the character round as opposed to elliptical cross section of the pod, both mono- and bifactorial results were observed, in which only the fully recessive was round.
The characteristics of the two types " Schwert– " and " Brechbohnen " are described. The former has always a wavy dorsal margin. Both 15 : 1 and 3 : 1 ratios were obtained in crosses between these two types. One of the two factors appeared to be loosely linked with green pod colour and also breadth of pod ; wide pod proved to be simply recessive to narrow in certain crosses within the same type but two distinct factors governing width were encountered.

635.652–2.483–1.521.6:575.1

718. SCHREIBER, F. 635.652:575.11
Resistenzzüchtung bei *Phaseolus vulgaris*. (**Breeding for resistance in *Phaseolus vulgaris*.**)
Phytopath. Zeits. 1932 : **4** : 415–54.

Fifty-seven varieties of bush beans were tested with the 34 races of *Colletotrichum Lindemuthianum* and only those were used that were immune to at least one race.
The races of *Colletotrichum* could be divided into three groups, A, B and C.
Resistance appears to depend on a physiological condition within the cells and the breeding of resistant varieties seems to be the only method for controlling the disease.
A bean has been bred in America and named " Anthracnose resistant dry shell pea bean Cornell No. 22," which is immune to 30 strains of anthracnose and highly resistant to the remaining 4. It is, however, not suitable for the market in Germany.
In order to produce such a variety, Anthracnose resistant was crossed both directly and reciprocally with Konserva and Wachs Beste von Allen, two of the best German garden beans and both highly susceptible to anthracnose.
The F_2 was tested with strains from each *Colletotrichum* group and the results shewed that there were three independent factors for resistance, corresponding to the three *Colletotrichum* groups.
The genetics of the colour of the bean and other characters were also investigated.
Colour depends on a basal factor A. There are two factors, M_1 and M_2 for marbling and both must be present to produce an effect. B is a factor for light brown, C is an intensifying factor and D is a factor for a dark ground ; these are only effective in the presence of A.

There are two factors for the marking of the hilum.
The climbing habit of growth is dominant to the bush habit and the inheritance is monofactorial.
Speckling of the pod is due to two factors C and R, both of which must be present.
The types of pod, flat and swollen and straight and curved are allelomorphic pairs which in combination shew linkage with 12·4 per cent of crossing-over.
The result has been the production of a bean possessing all the qualities demanded from it as a vegetable and for the canning industry and resistant to anthracnose.

719. RAEDER, J. M. 635.652–2.8–1.521.6
Value of new bean demonstrated.
The News Letter, Moscow, Idaho 1932 : **16** : 1–2.
The new mosaic-resistant bean Robust has almost immediately replaced other varieties previously grown. A resistant selection from Great Northern has similarly replaced the original type in other districts. This selection is characterized by high yield, uniform and high quality product. Crosses with resistant varieties have also been made.

720. MACKIE, W. W. and ESAU, K. 635.652–2.8–1.521.6:575
A preliminary report on resistance to curly top of sugar beet in bean hybrids and varieties.
Phytopathology 1932 : **22** : 207–16.
In hybrids between Robust and the resistant variety California Pink the resistance to the virus was shewn not to be directly correlated with the pink colour of the beans, although a greater proportion of the pink hybrids were resistant than of the white.
The Robust parent was resistant to mosaic and the hybrids indicate that it will be possible to create a variety resistant to both viruses.
A wide range of susceptibility to curly top was observed in all four species of bean examined, viz. common beans, butter beans, small Lima and Blackeye cowpea.

721. GIESSEN, C. VAN DER 635.655:575.42(92.2)
Op Java verbouwde kedeleevariëteiten. (**Soya bean varieties cultivated in Java.**)
Landbouw 1932 : **7** : 664–71.
Various strains selected from local varieties and from varieties imported from Formosa have proved superior in yield and quality.

722. DICKERSON, L. M. 635.656:575.061.6:581.48
The inheritance of Ruby seed coat color in peas.
J. Hered. 1931 : **22** : 319–21.
The character Ruby, designated Ru, was inherited on a single factor basis. The Ruby parent also carried the factor F for speckled seed coat. This character also shewed monofactorial inheritance although, probably on account of the difficulty in classification, the ratios were not in good agreement with the theoretical. Ru and F were inherited independently. The Ruby character was almost dominant in immature seeds but practically recessive in mature seeds. The delayed manifestation of the character G for grey seed coat is the probable reason for this behaviour.

723. BLARINGHEM, L., BRIDEL, M. and BOURDOUIL, C. 635.656:575.115:581.48
Sur la dominance du caractère amylacé dans les hybrides de première génération de deux variétés de pois (*Pisum sativum* L.) [**On the dominance of the character starchy in the first generation hybrids between two varieties of peas (*Pisum sativum* L.)**]
C. R. Acad. Sci. Paris 1931 : **193** : 1135–37.
An examination of the F_1's of reciprocal crosses shewed that high starch content was completely dominant to the wrinkled type. Certain other characters however, such as colour of the seed, size and shape, shewed clear differences in the reciprocal hybrids, being more influenced by the maternal than the paternal parent.

724. HÅKANSSON, A. 635.656:576.356.1
Neue Fälle von Chromosomenverkettung in *Pisum*. **(New cases of chromosome ring formation in *Pisum*.)**
Hereditas 1932 : **16** : 155–59.

Three more cases of sterility and ring formation are reported. Two of these are thought to be similar to the previous cases (see Plant Breeding Abstracts Vol. I. Abst. 446 and 605), the other is different, the formation of a closed ring being less frequent and triple chiasmata between the ends of three of the four chromosomes being often seen. The author thinks it probable that this is a case of the translocation of the end of one chromosome to the end of a non-homologous one.

725. SANSOME, E. R. 635.656:576.356.1
Segmental interchange in *Pisum sativum*.
Cytologia 1932 : **3** : 200–19.

By crossing the K and the T lines, each of which gives a ring of four chromosomes when crossed with the N line, a plant was produced which had an association of six chromosomes and was 70 per cent sterile. From this it is concluded that three chromosomes are involved in segmental interchange, one of which is common to the two lines. In addition to pairing with the chromosomes at each end, certain numbers of the six pair also with the chromosome opposite, giving rise to " median chiasmata." It is supposed that each of these two lines arose, by segmental interchange, from a common type, and that the interchange did not occur in the same place each time, with the result that a certain portion remained unaffected. The following stage leading to the possibility of the formation of median chiasmata could only have occurred as a result of crossing over.

The various types of gamete expected from this condition are indicated. Among the viable combinations expected are plants with rings of four chromosomes.

726. NILSSON, E. 635.656:581.47:575.061.5
De olika membrangenernas betydelse vid förädlingsarbetet med sockerärter. **(The importance of the different membrane genes in breeding work with varieties of sugar peas.)**
Nord. JordbrForskr. 1932 : 32–38.

The genes P and V are responsible for the thick membrane lining the wall of the pod of field peas. The three genotypes among sugar peas correspond to three different phenotypes : ppvv with no membrane, ppVV with a thin membrane along the dorsal and ventral edges and PPvv with a thin membrane covering the whole of the inside of the pod.

As regards quality ppvv types are the best, all varieties of ppVV are excellent sugar peas but among the PPvv types there are considerable differences. Whether these differences are only chance or are the result of genotypical differences is a matter for special investigation ; but the presence of modifying or intensifying genes is likely to affect most markedly the types with a thin membrane over the whole of the pod wall.

The mutation causing the thick pod of the field pea which occurs among sugar peas, occurs most frequently in the PPvv group, never in the ppvv group and probably never in the ppVV group, though a doubtful case is mentioned.

In choosing types for crossing it is therefore important to find lines without the P gene.

The most common V types on the market, such as Bismarck, Luxuria, De Grace, have however relatively small pods which is also true of the pv type, while the large podded varieties such as Engelsk sabel, Grå jätte, Jättesabel, are generally of the P type. Whether this is a matter of chance, or whether there is a correlation between these characters, deserves further investigation. Rasmusson's work has shewn that the correlation, if such exists, is at least not absolute.

CASTLE, W. E. 575
575.191

Genetics and eugenics: a text-book for students of biology and a reference book for animal and plant breeders.

Cambridge, Mass.: Harvard University Press; London: Oxford University Press, 1930: 474 pp. illus. 16/6 net.

The science of genetics has advanced to no mean extent since the publication of the third edition of this work and considerable sections have therefore been entirely re-written in this, the fourth edition.

Matter of interest to plant breeders will be found in all the sections: thus the first part, entitled "The Biological Basis of Genetics" contains an exposition of the role of the chromosomes in the mechanism of heredity, with a brief reference to polyploidy. The theory of evolution is expounded at considerable length, leading on to the study of variation, mutation, and Mendelism, the principles of which are explained very fully.

The unit characters for a number of animals and plants are described and illustrated. The various types of factors are described and artificial modification of factors by X-rays and other agents is briefly touched upon in a particularly interesting way. The author enlarges upon the different ways in which new characters and new types may arise and the part they have played in the origin of variation, i.e. of the material for selection, and so of present day races of domestic plants and animals; a striking body of evidence is brought together to illustrate the major part which gene changes combined with selection may play in the origin of forms. The larger question of the origin of species and of genera is passed over rather cursorily.

Of more immediate interest to the plant breeder will be the full treatment accorded to questions of cross breeding, inbreeding and hybrid vigour, in which it is shewn that some organisms are indifferent whereas others suffer very severely when subjected to inbreeding or may be completely self-sterile. The role of inbreeding in revealing, not creating, inherent defects is duly emphasized.

The improvement which the application of the laws of genetics may bring about is illustrated, in a brief chapter on the "Principles of Plant Breeding," for cultivated plants, the amelioration of which owes more than any other group of organisms to this science. The probable origin of the cultivated wheats by chromosome duplication following upon interspecific hybridization is explained and the dependence of many of the best plant strains on hybrid vigour is pointed out —either directly, as in maize, or followed by vegetative propagation, as in most fruits.

The preponderance of multiple and modifying factors in the inheritance of characters of economic importance is shewn to be the cause of the failure of such characters to obey the simple Mendelian laws.

The last five chapters are devoted to eugenics.

ZIMMERMANN, W. 576.16

Arbeitsweise der botanischen Phylogenetik und anderer Gruppierungswissenschaften. (**Methods of investigation in phylogenetical botany and other systematic sciences**).

Abderhalden Handb. biol. Arbeitsmethoden 1931: Abt. 9: (3) (6): Lief. 356: 941–1053.

The Plant Kingdom as we know it is made up of individuals in almost endless diversity. As a basis of study of any kind these have to be classified and the present number of Dr. Emil Abderhalden's well-known manual, which is the latest addition to a series of genetical monographs, deals with the classification of these individuals according to phylogenetic principles, the only form of classification which expresses natural relationships.

The principles upon which the method rests are discussed at great length, together with the implications. The lines of argument are outlined and discussed—the degree to which similarity is a criterion of relationship, the principle that widely distributed characters are more primitive than rare characters limited to a small number of forms, the arguments of correlation and analogy

between characters, ontogenetical evidence and reduced or vestigial organs, as also the way in which these principles may be used in making deductions.
Next come the parts played by comparative morphology and anatomy, ontogeny, comparative phytogeography and serology in phylogenetical investigation. The latter is recognised as a very valuable instrument in arriving at conclusions of inter-relationship but certain limitations of the method are pointed out. The contribution which hybridization and pure genetic studies can make in this direction is mentioned, an indication being given of the light thrown by these studies on the mode of origin of certain species and the relationships between forms as a whole. It is pointed out, however, that many factors beyond relationship influence the result of hybridization. A close correspondence is shewn to exist between gene mutations, which we now recognise as the normal mutational process in nature, and the " continuous evolutional change " of Darwinian theory.
The study shews that no character has escaped a phyletic modification, that the diversity of forms can be arranged in groups of closely related forms and of less closely related groups, from which some sort of genealogical tree can be made, both with regard to races and to characters, paleontology indicating the main lines of this.
The present survey, although confined rather strictly to the German school of botanists, affords a very adequate summing up of phylogenetic theory from this point of view.

KIHARA, H., YAMAMOTO, Y. and HOSONO, S. 633:576.312.35
A list of chromosome numbers of plants cultivated in Japan.
Nakanishiya Book Co., Kyoto 1931 : 136 pp. 2.30 Yen.
A list of the cultivated plants of Japan and the neighbouring regions, giving the haploid and diploid chromosome numbers where they are known, with the authorities.
The crops are classified into common, forage, industrial, medical, manuring, fruit and vegetable, stocks, garden flowers, trees and shrubs, and arranged according to families.

CRAWFORD, M. D. C. 633.51
The heritage of cotton, the fibre of two worlds and many ages.
G. P. Putnam's Sons, New York and London : 1931 : 244 pp. illus. 21/-.
An account of the development of the use of cotton through the ages, in non-technical language and with ample illustrations. Indications are given of how research in technology has added to progress and of a number of things which remain to be done.

COPELAND, E. B. 634.61
The coconut.
Macmillan and Co., Ltd., London 1931 : pp. xviii + 233. 3rd edition. Price 20s.
The third edition of this useful manual on the coconut. Together with a number of general questions, which although of primary importance both to the grower and the breeder cannot be touched upon here, the author very briefly discusses the question of the origin of the coconut, which is now ascribed to the islands of the Indian Ocean, and devotes the fourth chapter to the varieties of coconut, referring to the absence of pure races and the confusion which has so far existed in the whole question of varietal differences. Descriptions are given of a number of varieties distinguished in the Philippines, with figures indicating their respective yielding capacities, size of nut, etc. in different parts of the world. The choice of type of palm for different industries is discussed, together with reference to a number of unusual types suited to special markets.
How far the varieties identified in different countries are identical and how true they will breed is still a matter for investigation.
The second half of this chapter is devoted to the selection of seed. Useful hints are given as to how this may most profitably be carried out, illustrated by reference to statistical yield data obtained in Malaya and the Philippines and studies of the progenies from superior trees in Malaya and Ceylon. The importance of the pollen parent is emphasized, together with various points in dealing with the nuts to be used for seed.

SIRKS, M. J. 635.651:575.11
Beiträge zu einer Genotypischen Analyse der Ackerbohne, *Vicia Faba* L. **(Contributions to a genotypical analysis of the field bean, *Vicia Faba* L.)** Martinus Nijhoff, The Hague, 1932 : 422 pp. illus. 22 guilders. (Reprint from "Genetica" 1931 : 13 : 209–631).

As the author points out in the introduction, full genetic analysis of the species, fitting the characters into linkage groups corresponding to the six chromosome pairs, is not easy, since most of the distinguishing characters are of quantitative nature and give complicated ratios in inheritance. The study, on the other hand, has led to many important conclusions on the subject of the inheritance of quantitative characters which otherwise might not have been reached. In this, therefore, the present monograph is in many ways of unique interest. The author has already published certain brief communications but the present work is a full presentation of the results of over fifteen years' investigations, giving the technical details of the methods, tabulating and describing the full results and reviewing the work of other writers.

The large and small-seeded groups are clearly distinct sub-species in that they do not intercross with the same ease as varieties within the groups, natural hybrids of this type being unknown, the F_1's displaying a certain degree of sterility and the reciprocal crosses being not always identical. The sub-species *major* must usually be used as female, since split seeds frequently result from the reciprocal cross.

The characters are dealt with in turn. Erect habit proved to be a simple dominant to prostrate, the double recessive, however, being non-viable when *minor* plants were used as female parents. For internode number a series of three allelomorphs was established, I_3–I_2–I_1. Stem length was conditioned also by a second series of allelomorphs, G_4–G_1, independent of the first series. These two sets of factors governing stem length are not manifested in the prostrate type, the G set is more active in plants of the *minor* group than of the *major*, with the result that reciprocal crosses between these two are not identical. A negative correlation was observed between stem length and number of stems per plant and the two are dependent on the same factors.

The number of leaflets was found also to be governed by the I_1–I_3 series responsible for the internode number and a study of growth curves of the leaves shewed that leaf dimensions were governed by a series of triple allelomorphs identical with G_4–G_1 for stem length, with a further factor group T_1–T_2 intensifying the length of the terminal portion of the leaf and similar factors W and B intensifying the width and length of the basal portion of the leaf respectively. In this case there is no difference in the behaviour of the G factors in the *major* and *minor* lines ; with *minor* as female parent, however, the double dominants for B, T_1 and T_2 were lethal.

Two factors for leaf colour were determined, A and C_3 ; the presence of both gives normal, absence of A "*subtypica*" and absence of both *albina*. Allelomorphic with C_3 are C_1, *chlorina* and C_2, *semichlorina*. A further factor V acts on C_3 and C_2, producing variegation and on segregation of this factor in *variegata*-plasm the v gametes, whilst in *subtypica* plasm the V gametes, are eliminated ; in *typica* plasm the segregation occurs normally. The A factor is epistatic to all other factors ; the double recessive aa, moreover, is not viable in *minor* plasm.

Peculiar marginal indentations resulting from local absence of palisade cells, proved to be a simple dominant, F, and a type characterized by the premature shedding of the leaves gave 1 : 2 : 1 ratios. Another peculiar form without leaves on the inflorescence was conditioned by a dominant factor If, which was transmitted only by the egg cells and not by the pollen.

The presence of the black patch on the flower was governed by one dominant factor O, the double recessive being again non-viable in *minor* plasm. This factor also produces a black patch on the stipules and is necessary for the manifestation of the anthocyanin producing allelomorphs z–Z_1–Z_2, which in turn are necessary for the manifestation of the dominant factor X, which gives the anthocyanin a bluish shade. The Z factors produce a more intense coloration in *minor* than in *major* plasm.

Comparison of the foregoing results with those for the number of seeds per pod demonstrated the identity of the factor groups I_1–I_3, B_1–b and T_2–t with those governing number of seeds. The lethal nature of the double dominants $B_1\,B_1$, $T_2\,T_2$, $T_2\,T_1$ and $T_1\,T_1$ is hereby also confirmed.

Fruit length in the various crosses behaved in a way which indicated that at least four distinct factors were concerned. Crosses within the *minor* group shewed that here one group of triple

allelomorphs accounted for all the differences observed. Much longer fruits were formed with *major* than with *minor* as female parent. Comparison with foregoing results and correlation studies with leaflet lengths shewed that the same group G_1–G_4 was responsible also for fruit length and that the B and T factors were also concerned, as well as the internode number factors I. In consequence of the combination of these factors the F_1 plants usually bore considerably longer fruits than the parents. The G factors were again not expressed in the prostrate types. The fruit width in a similar way proved to be correlated with leaf width and conditioned by the same factors G and W ; the factors were more intensely expressed in *major* than in *minor* plasm.

A factor Q was determined, which gave normal leathery pods as opposed to rough wavy ones and in presence of Q a further intensifying factor S transformed the normal into leathery pods which burst at maturity. Another pod factor, D, causing an uncommonly strong development of downy hairs on the inner surface of the pods, was established.

Seed size investigations were complicated by the fact that when the female parent had smaller seeds than the male, the hybrid seeds were reduced in their development by the seed coat ; this effect might go so far as to result in the splitting of the seed coat. Certain crosses gave clear ratios in the second seed generation, however, and from these it became clear that the length and breadth of the seeds were influenced by the same factors, which further proved to be the same G group acting on other organs. In addition to this the factors B and T exercise a special influence on the seed length and W on the breadth. The T factors seemed to displace the hilum from the centre in one direction, the B factor in the opposite direction. In addition to the effect of the seed coat, it was clear also that the seed size factors were expressed to a lower degree in *minor* than in *major* plasm. In addition to these there were observed factors K for shiny seeds and R for black flecks on the seed margins. Seed colour was primarily dependent on O which was described above under flower colour ; in the absence of O whitish grey seeds are produced, which are converted by Y into yellowish-white. O with P gives yellow, with the recessive p purple seeds. The purple is more intense in *minor* than *major* and the double recessive oo is again seen to be non-viable in *minor* plasm. A further factor Sc in presence of O produces black seeds and a factor M causing mottling of the seeds, is linked with O, on account of which the double recessive is eliminated in certain crosses between *major* and *minor* ; the mottling is manifested only in plants possessing O. The colour of the hilum is governed by N but is influenced to a certain extent also by the other colour factors.

A peculiar type of semi-sterile plant is described and shewn to be a simple recessive. Furthermore a clearly defined zygotic sterility of a little over 25 per cent was observed in *minor* x *major* crosses, i.e. where the *minor* served as the female parent. This sterility was not observed in any of the other crosses.

Out of the 26 factors established and studied, 19 grouped themselves clearly into 4 linkage groups. The remaining factors have so far not shewn any linkage. Charts are given of the position of the genes in the 4 chromosomes as at present visualized.

The importance of the work will be obvious from this outline. It affords a striking example of the fact that a complicated and apparently unfathomable state of things, such as has often appeared in the inheritance of quantitative characters, is frequently the result of insufficiently detailed and systematic study on the part of previous workers. The disclosure that many of the sets of factors previously reported as governing the inheritance of various characters in different parts of the plant are identical should in itself throw a flood of light on the inheritance of quantitative characters and the methods of their investigation, not only in this species, but in the plant kingdom as a whole. The widely representative material and the extensive crossing programme has afforded admirable opportunities not only of comparing the inheritance of one character with that of another but also of observing the effect of a single factor isolated, as it were, from all the others which may influence the same character. In this way for instance the actual growth curve of a particular organ has been shewn to be dependent upon definite factors and surely this is no small step both in the study of the inheritance and of the physiology of growth. Tables are given in the case of most of the characters shewing the exact phenotype produced by all the different combinations of factors. Another fact established by this method of study, namely that different factors may operate at different times in the development of the individual, is also not without interest.

The difference in reaction of the two sub-species to the same genes and particularly the fact that with regard to the G factors the *major* reacts more than the *minor* in the fruit, less than *minor* in stem length and identically in the leaves, is also of interest in connection with the physiological action of the gene and its relation to the plasma. In this respect a further point is significant, namely that all the factors which proved to be non-viable in the homozygous state in *minor* plasm are linked and evidently occur in the same chromosome.

Amongst other questions of theoretical interest evoked by the present observations is the bearing of multiple allelomorphs on the nature of the gene. The occurrence in crosses between two extremes of a series, such as G_1 and G_4, of a small number of plants of the intermediate type, G_2 or G_3, suggests the possibility of " crossing-over " between different parts of the gene. It is also significant that the quantitative phenotypical differences between each member of the series such as G_1–G_2–G_3–G_4 are equal.

The author proposes to discuss this question further in later publications.

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